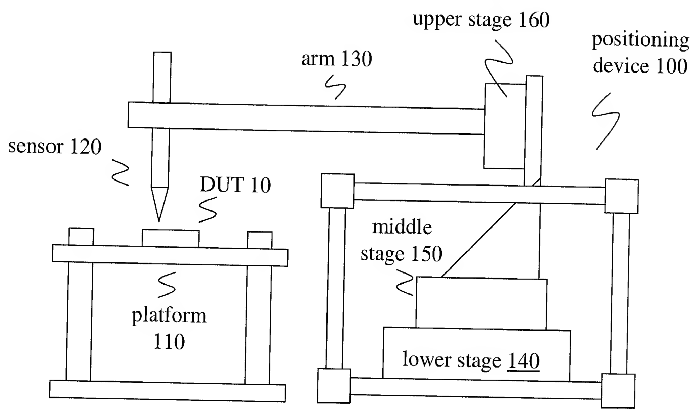

upper stage 160
positioning
device 100
arm 130
sensor 120
DUT 10
middle
stage 150
platform
110
lower stage 140

FIG. 1

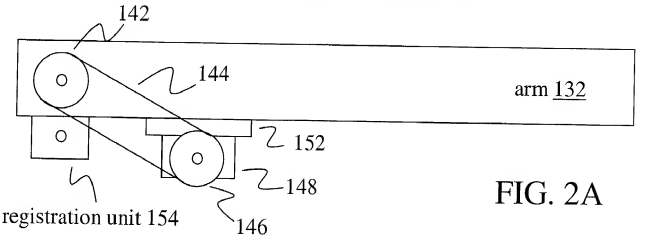


FIG. 2A

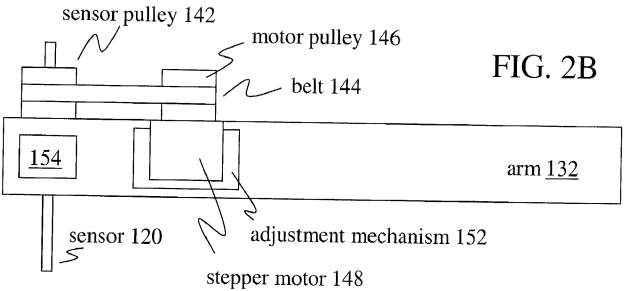


FIG. 2B

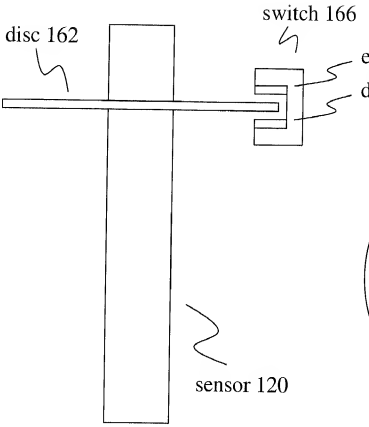


FIG. 3A

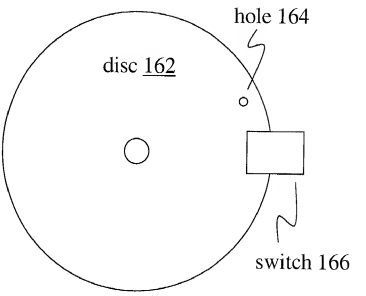


FIG. 3B

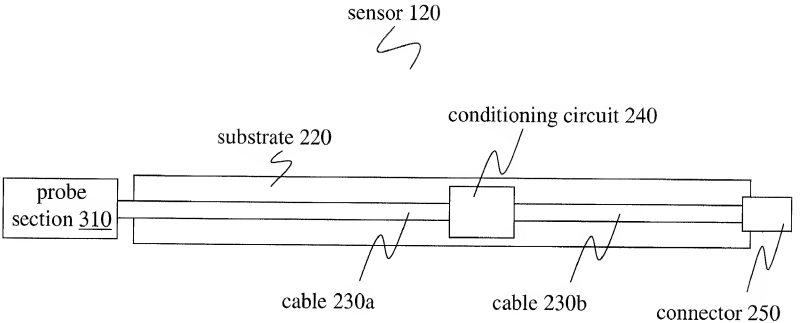


FIG. 4

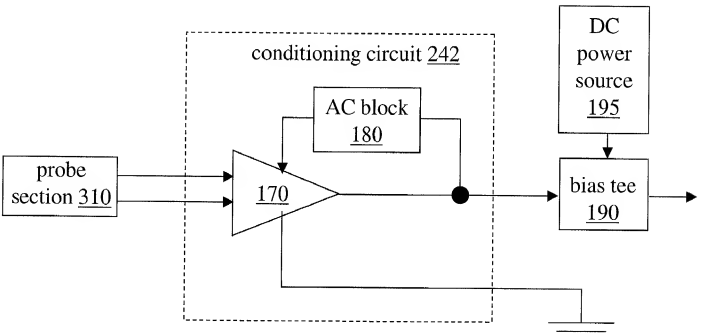


FIG. 5

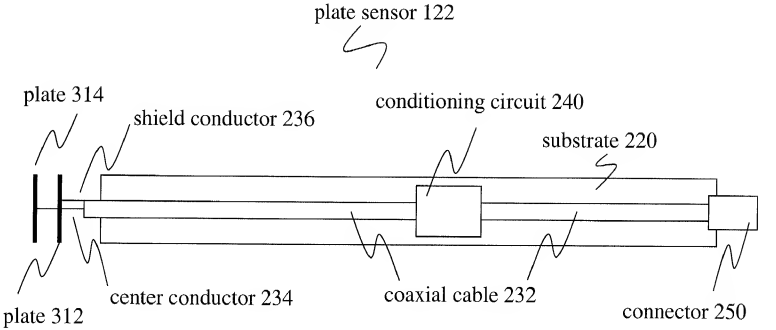
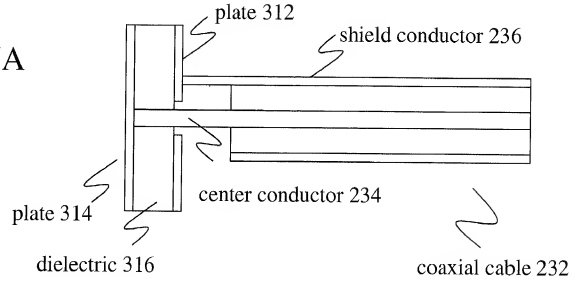


FIG. 6

FIG. 7A



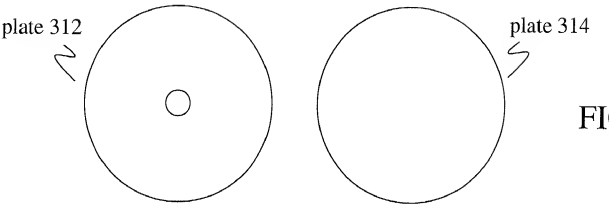


FIG. 7B

FIG. 8

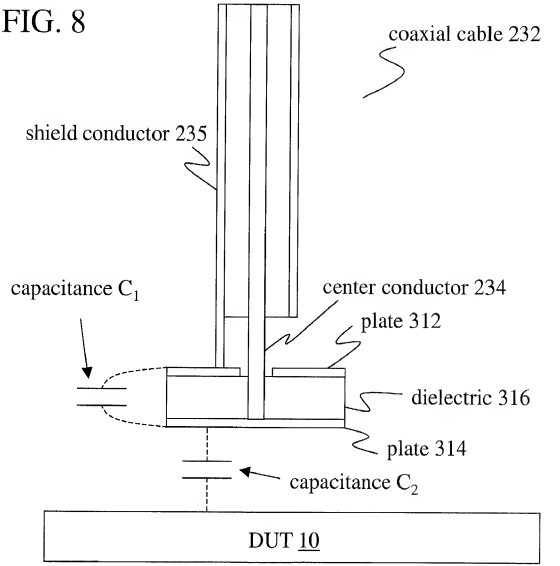

coaxial cable 232
shield conductor 235
capacitance C_1
center conductor 234
plate 312
dielectric 316
plate 314
capacitance C_2
DUT 10

FIG. 9A

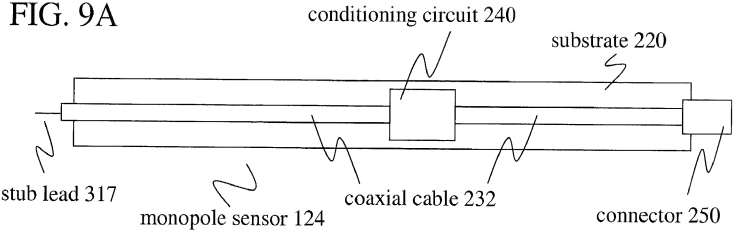
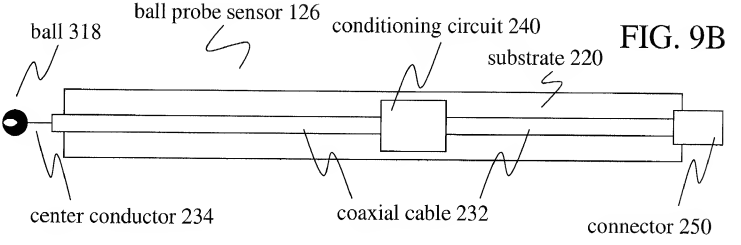


FIG. 9B



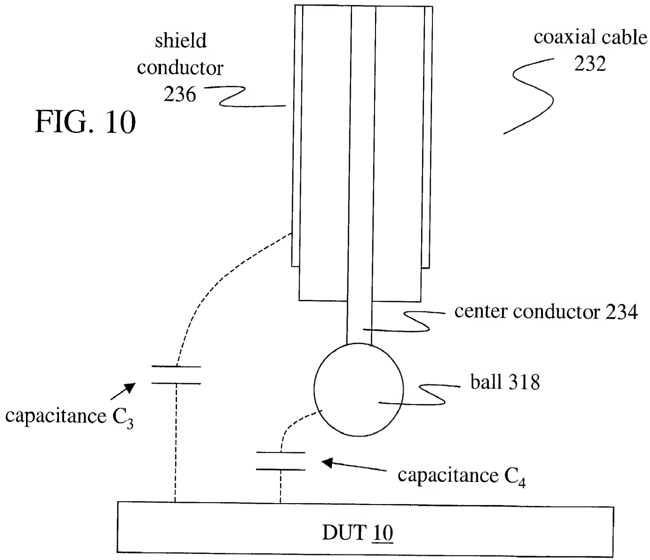

shield conductor 236
coaxial cable 232
center conductor 234
ball 318
capacitance C_3
capacitance C_4
DUT 10

FIG. 10

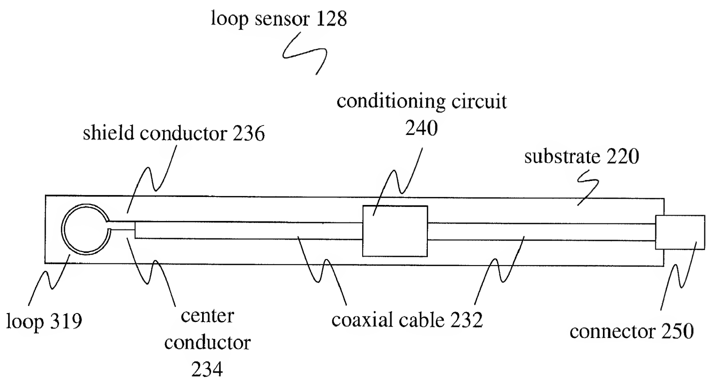

loop sensor 128
conditioning circuit
240
shield conductor 236
substrate 220
loop 319
center
conductor
234
coaxial cable 232
connector 250

FIG. 11

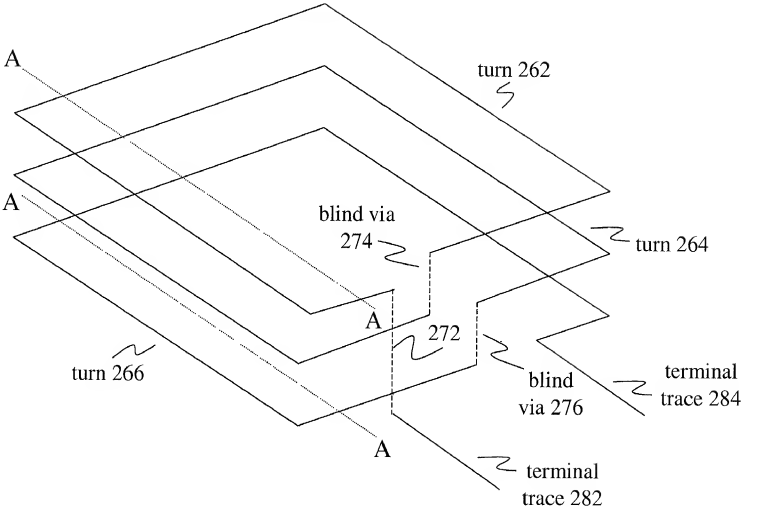


FIG. 12

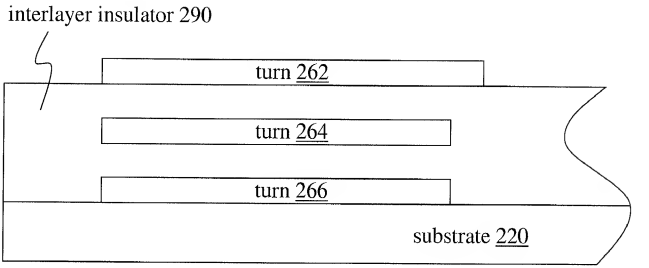

interlayer insulator 290
turn 262
turn 264
turn 266
substrate 220

FIG. 13

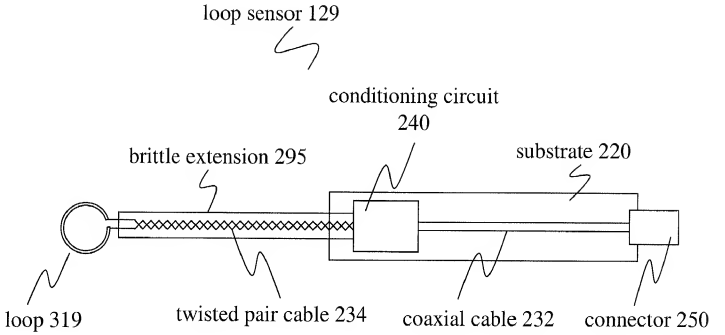


FIG. 14

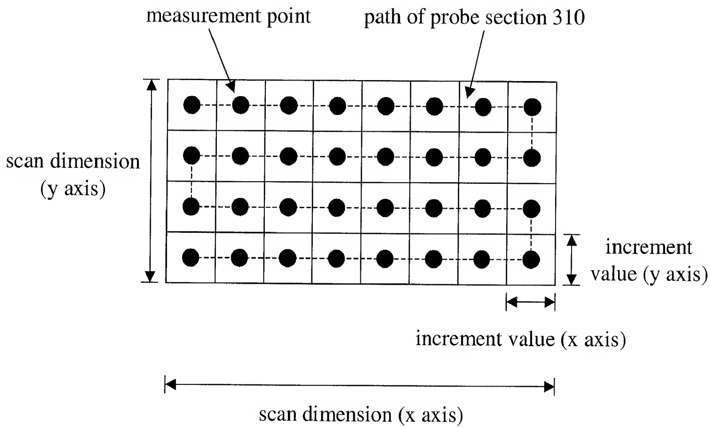

measurement point
path of probe section 310
scan dimension
(y axis)
increment
value (y axis)
increment value (x axis)
scan dimension (x axis)

FIG. 15

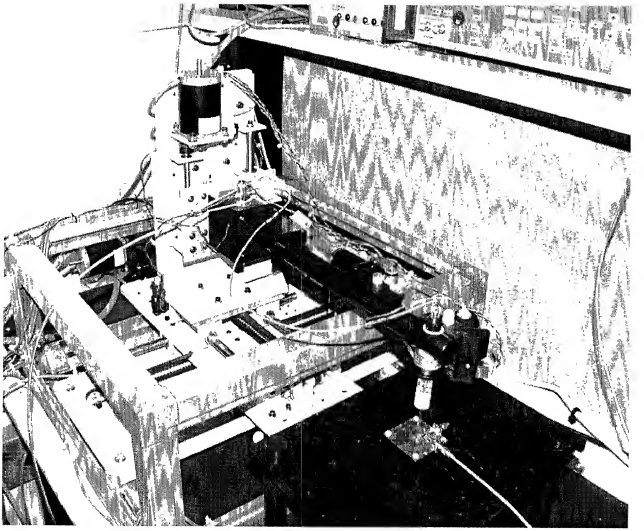


FIG. 16

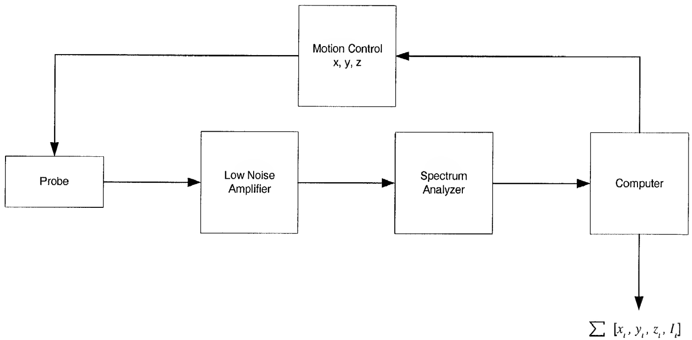

Motion Control
x, y, z
Probe
Low Noise
Amplifier
Spectrum
Analyzer
Computer
$\sum [x_i, y_i, z_i, I_i]$

FIG. 17

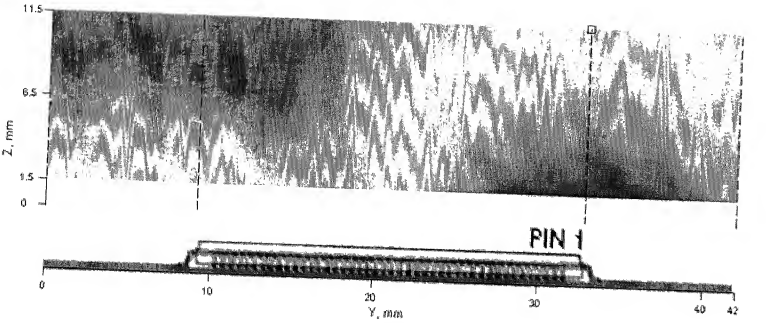


FIG. 18

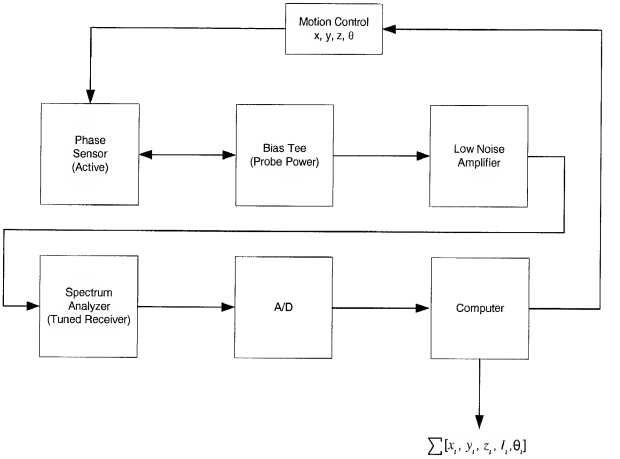


FIG. 19

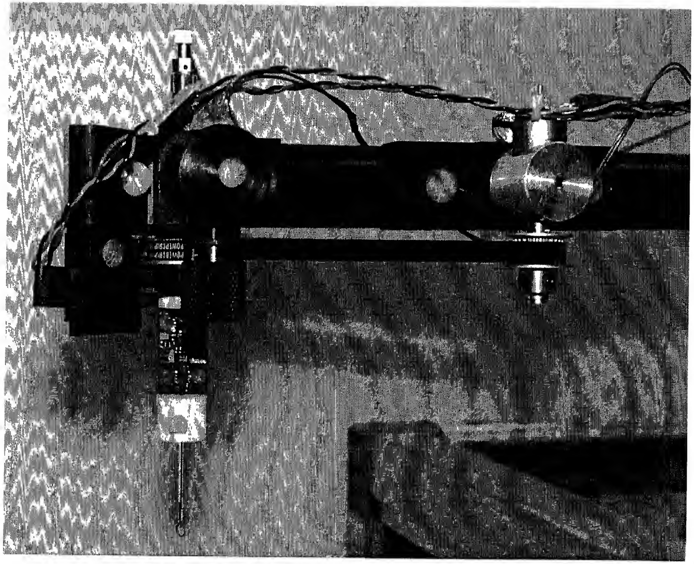


FIG. 20

11/16/99 - Micro stripline is terminated in 50 ohms.   Frequency: 1000 MHz
Probe Type: Magnetic Field.   Measurement Increments: dx: 1.94 mm, dy: 1.97 mm, dz: 0 mm
Number of Planes: 1, at 14.52 mm above DUT.   Magnetic Field Intensity Unit: dB uA/m.

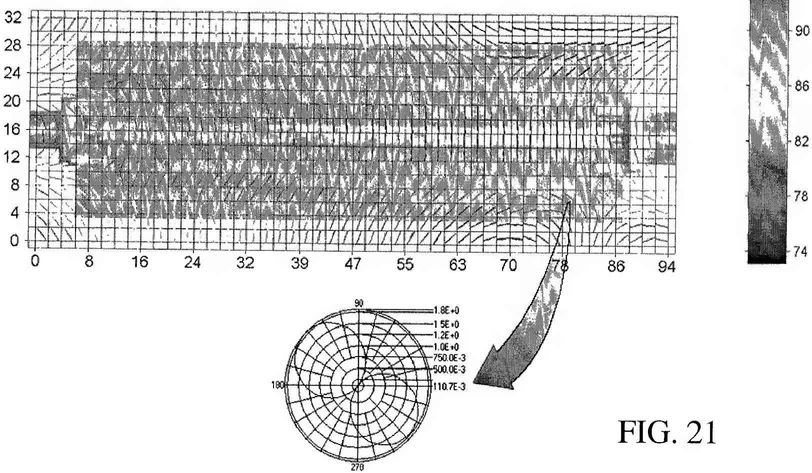


FIG. 21

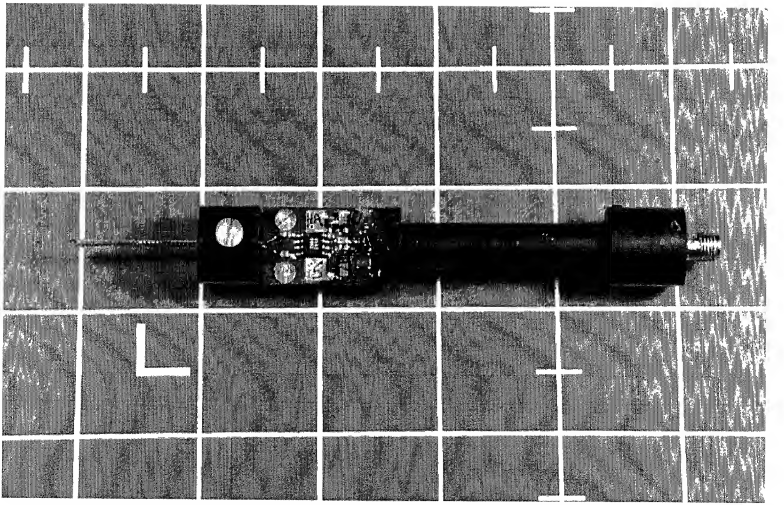


FIG. 22

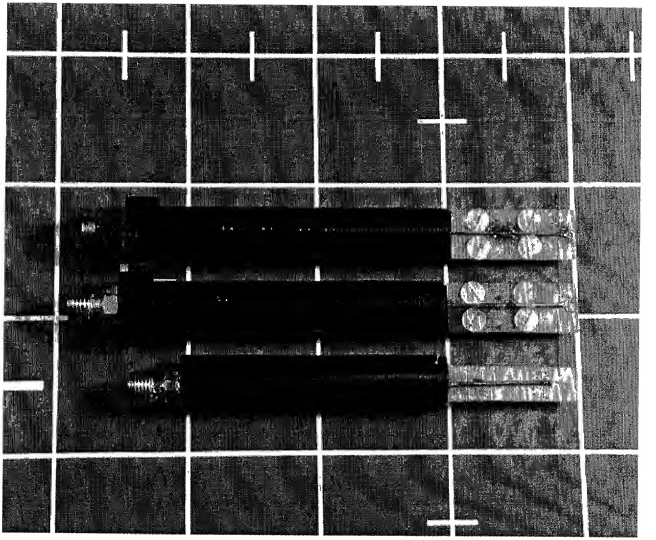


FIG. 23

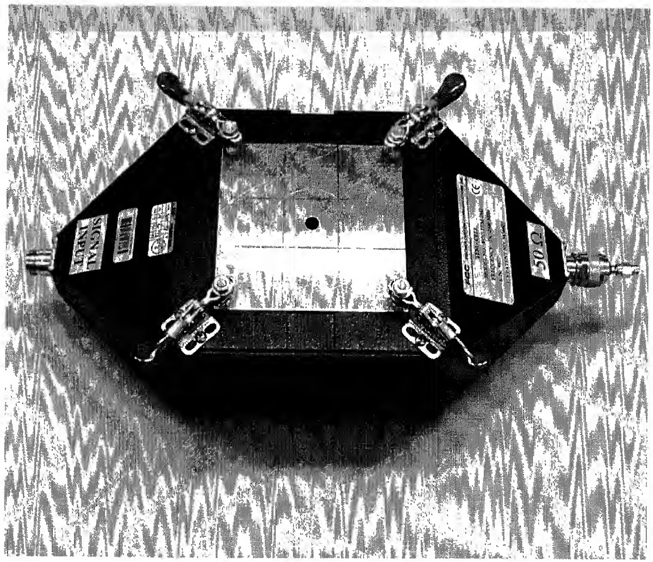


FIG. 24

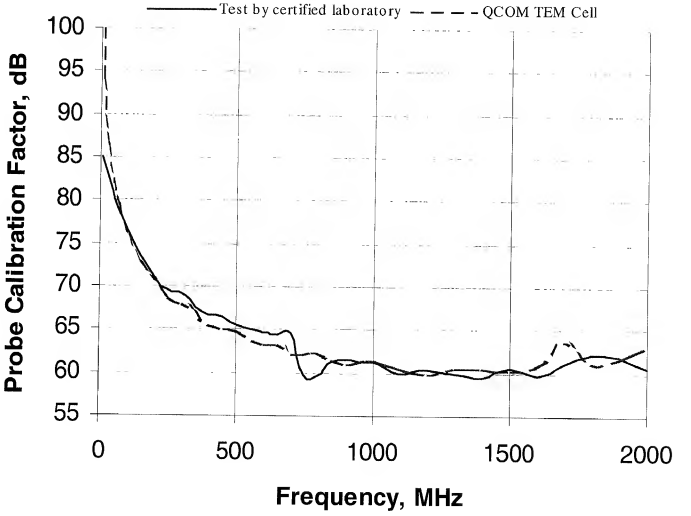


FIG. 25

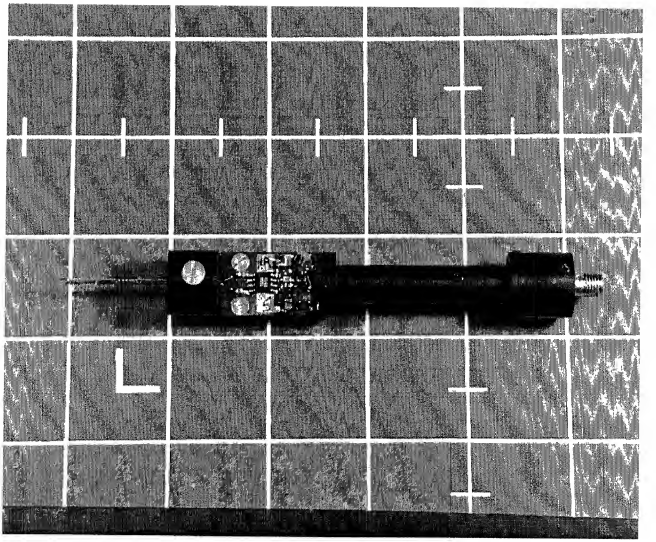


FIG. 26

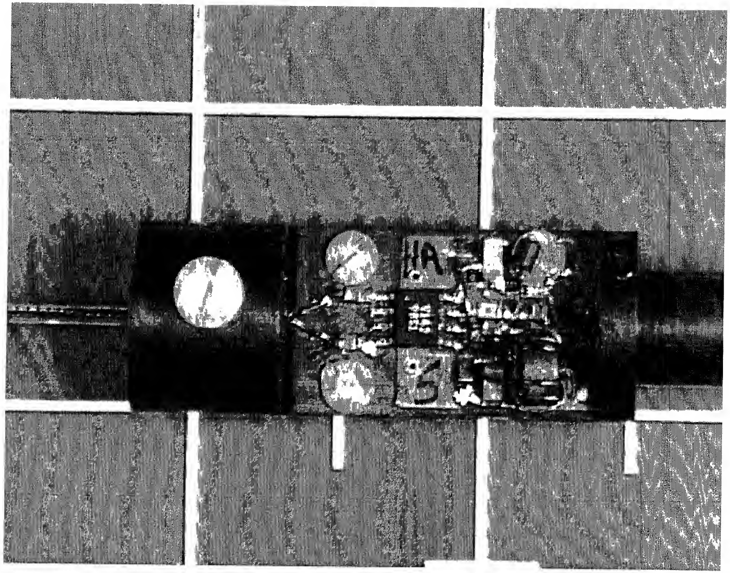


FIG. 27

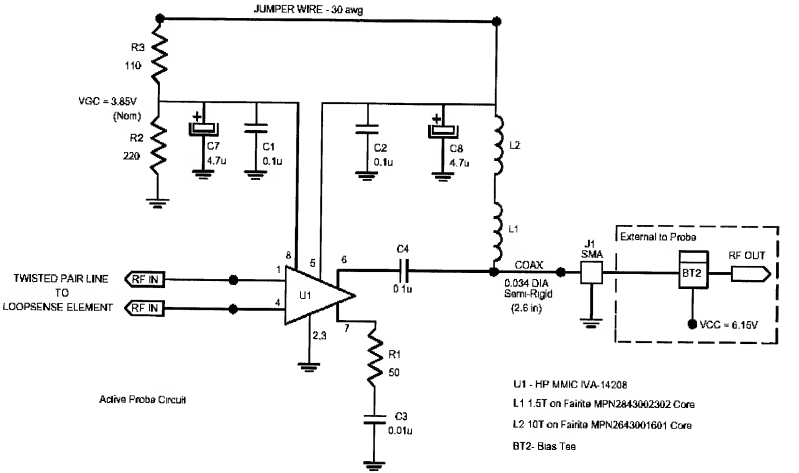

JUMPER WIRE - 30 awg
R3
110
VGC = 3.85V
(Nom)
R2
220
C7
4.7u
C1
0.1u
C2
0.1u
C8
4.7u
L2
L1
J1
SMA
External to Probe
RF OUT
BT2
VCC = 6.15V
C4
0.1u
COAX
0.034 DIA
Semi-Rigid
(2.6 in)
TWISTED PAIR LINE
TO
LOOPSENSE ELEMENT
RF IN
RF IN
U1
R1
50
C3
0.01u
Active Proba Circuit
U1 - HP MMIC IVA-14208
L1 1.5T on Fairite MPN2643002302 Core
L2 10T on Fairite MPN2643001601 Core
BT2- Bias Tee

FIG. 28

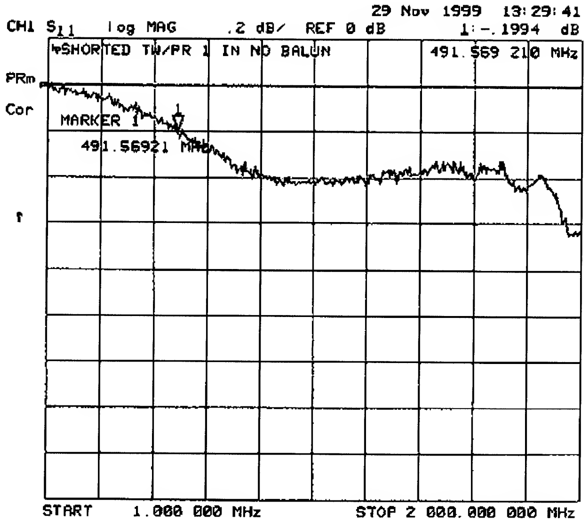
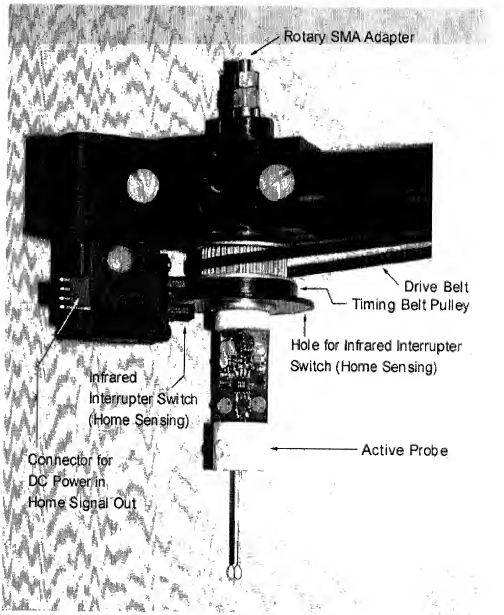

29 Nov 1999 13:29:41
CH1 S11 log MAG .2 dB/ REF 0 dB 1:-.1994 dB
SHORTED TW/PR 1 IN NO BALUN
491.569 210 MHz
PRm
Cor
MARKER 1
491.56921 MHz
START 1.000 000 MHz
STOP 2 000.000 000 MHz

FIG. 29

FIG. 30


Rotary SMA Adapter
Drive Belt
Timing Belt Pulley
Hole for Infrared Interrupter Switch (Home Sensing)
Infrared Interrupter Switch (Home Sensing)
Active Probe
Connector for DC Power in, Home Signal Out

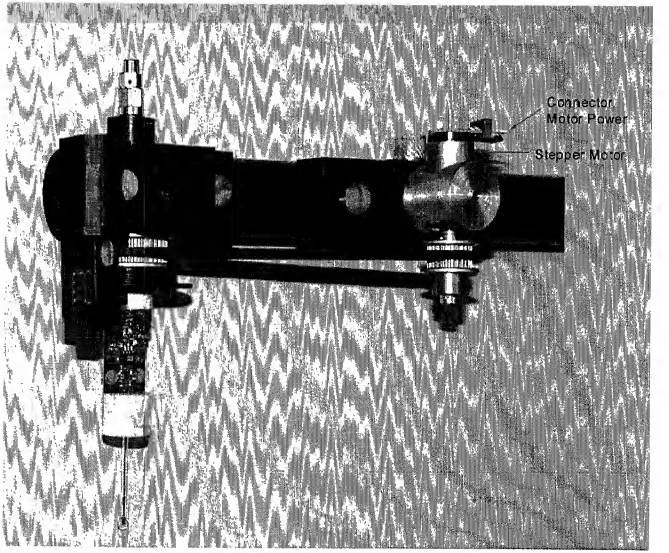


FIG. 31

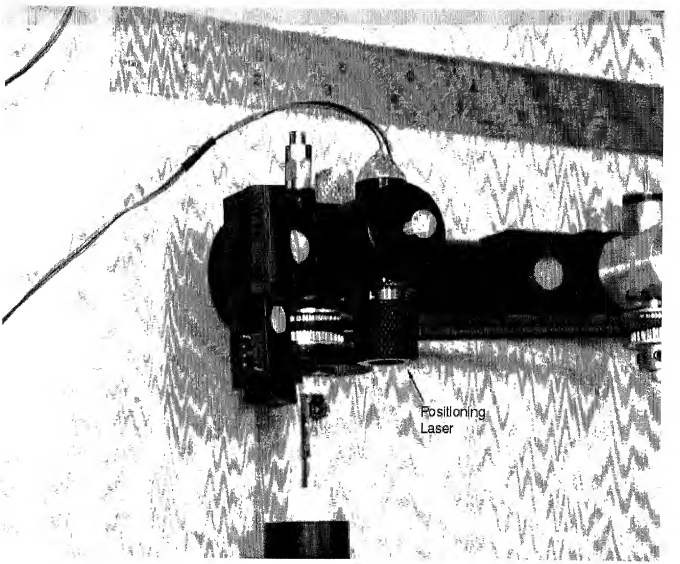


FIG. 32

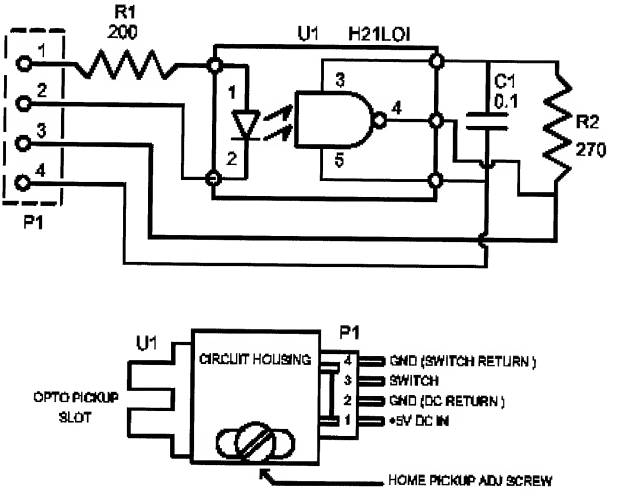


FIG. 33

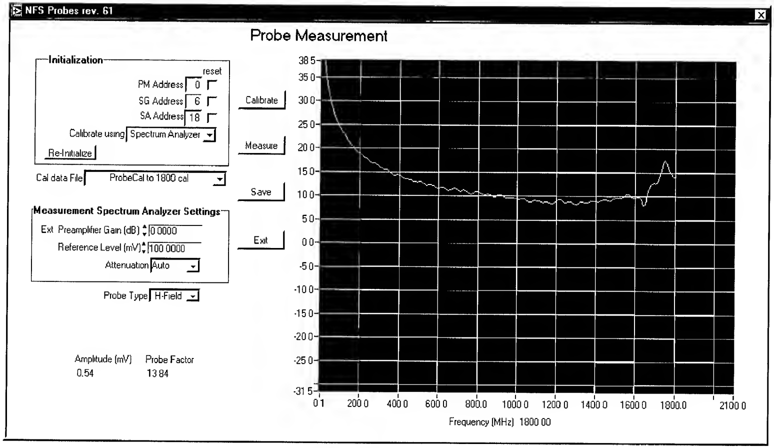

NFS Probes rev. 61
Probe Measurement
Initialization
reset
PM Address 0
SG Address 6
SA Address 18
Calibrate using Spectrum Analyzer
Re-Initialize
Cal data File ProbeCal to 1800 cal
Measurement Spectrum Analyzer Settings
Ext Preamplifier Gain (dB) 0 0000
Reference Level (mV) 100 0000
Attenuation Auto
Probe Type H-Field
Amplitude (mV) 0.54
Probe Factor 13 84
Calibrate
Measure
Save
Exit
38 5
35 0
30 0
25 0
20 0
15 0
10 0
5 0
0 0
-5 0
-10 0
-15 0
-20 0
-25 0
-31 5
0 1
200 0
400 0
600 0
800.0
1000 0
1200 0
1400 0
1600 0
1800.0
2100 0
Frequency (MHz) 1800 00

FIG. 34

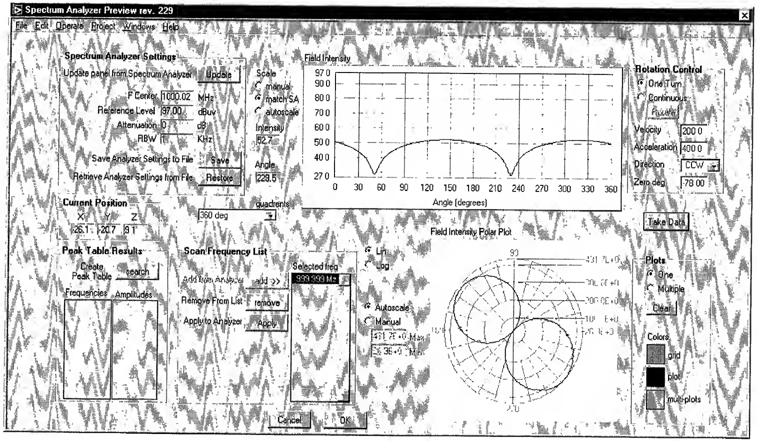

Spectrum Analyzer Preview rev. 229
File Edit Operate Project Windows Help
Spectrum Analyzer Settings
Update panel from Spectrum Analyzer
Update
F Center 1000.02 MHz
Reference Level 97.00 dBuv
Attenuation 0 dB
RBW 1 KHz
Save Analyzer Settings to File
Save
Retrieve Analyzer Settings from File
Restore
Scale
manual
match SA
autoscale
Intensity
52.7
Angle
229.5
quadrents
360 deg
Field Intensity
97 0
90 0
80 0
70 0
60 0
50 0
40 0
27 0
0 30 60 90 120 150 180 210 240 270 300 330 360
Angle (degrees)
Rotation Control
One Turn
Continuous
Velocity 200 0
Acceleration 400 0
Direction CCW
Zero deg 78 00
Take Data
Current Position
X Y Z
26.1 -20.7 9 1
Peak Table Results
Create Peak Table
search
Frequencies
Amplitudes
Scan Frequency List
add >>
Remove From List
remove
Apply to Analyzer
Apply
Selected freq
999.999 Mz
Lin
Log
Autoscale
Manual
Max
Min
Field Intensity Polar Plot
90
Plots
One
Multiple
Clear
Colors
grid
plot
multi-plots
Cancel
OK

FIG. 35

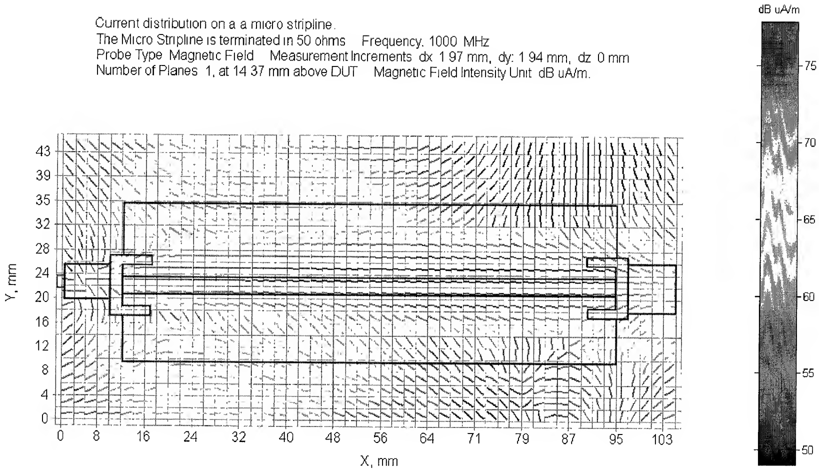

Current distribution on a a micro stripline.
The Micro Stripline is terminated in 50 ohms   Frequency. 1000 MHz
Probe Type Magnetic Field   Measurement Increments dx 1 97 mm, dy: 1 94 mm, dz 0 mm
Number of Planes 1, at 14 37 mm above DUT   Magnetic Field Intensity Unit dB uA/m.
dB uA/m
75
70
65
60
55
50
Y, mm
43
39
35
32
28
24
20
16
12
8
4
0
0
8
16
24
32
40
48
56
64
71
79
87
95
103
X, mm

FIG. 36

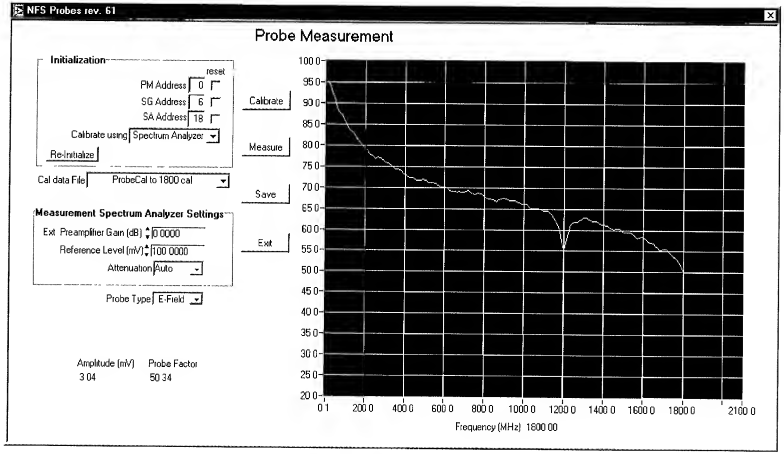

NFS Probes rev. 61
Probe Measurement
Initialization
reset
PM Address 0
SG Address 6
SA Address 18
Calibrate using Spectrum Analyzer
Re-Initialize
Cal data File ProbeCal to 1800 cal
Measurement Spectrum Analyzer Settings
Ext Preamplifier Gain (dB) 0 0000
Reference Level (mV) 100 0000
Attenuation Auto
Probe Type E-Field
Amplitude (mV) 3 04
Probe Factor 50 34
Calibrate
Measure
Save
Exit
100 0
95 0
90 0
85 0
80 0
75 0
70 0
65 0
60 0
55 0
50 0
45 0
40 0
35 0
30 0
25 0
20 0
0 1
200 0
400 0
600 0
800 0
1000 0
1200 0
1400 0
1600 0
1800 0
2100 0
Frequency (MHz) 1800 00

FIG. 37

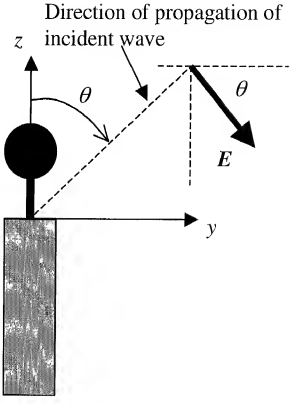


FIG. 38

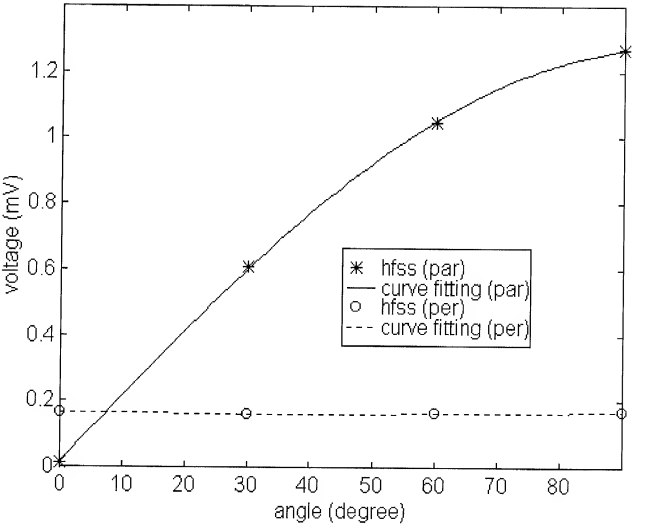


FIG. 39

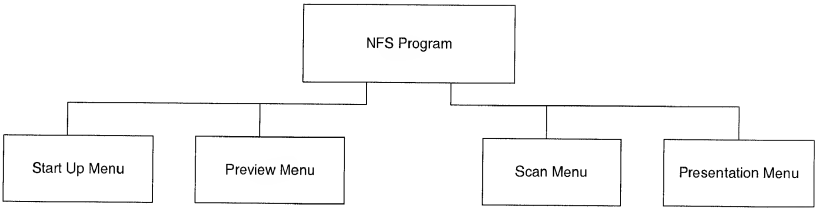

NFS Program
Start Up Menu
Preview Menu
Scan Menu
Presentation Menu

FIG. 40

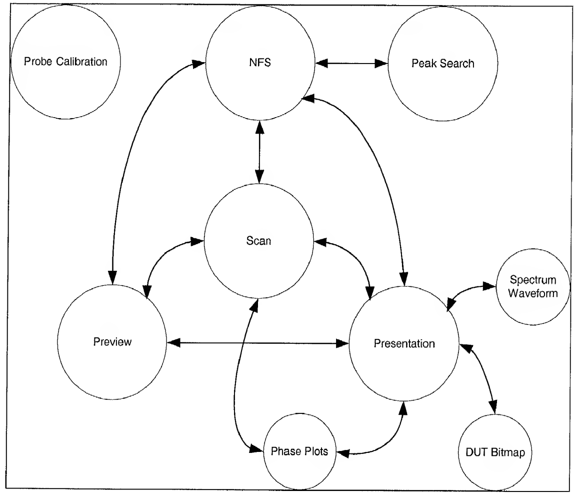
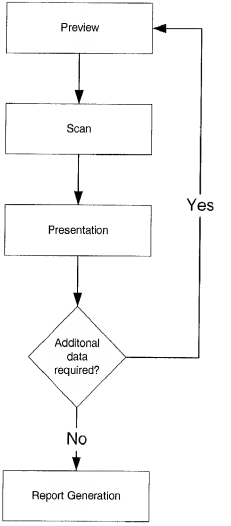

Probe Calibration
NFS
Peak Search
Scan
Preview
Presentation
Spectrum
Waveform
Phase Plots
DUT Bitmap

FIG. 41

FIG. 42



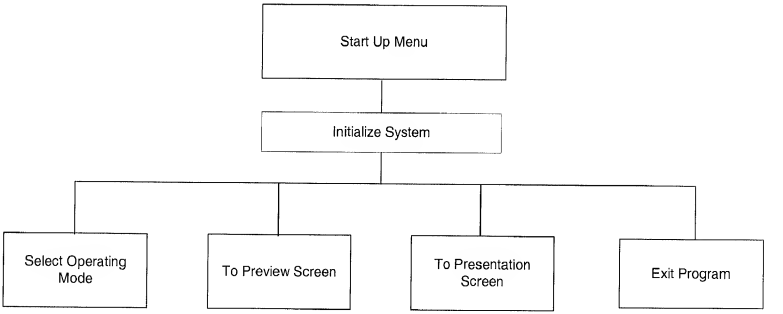


FIG. 43

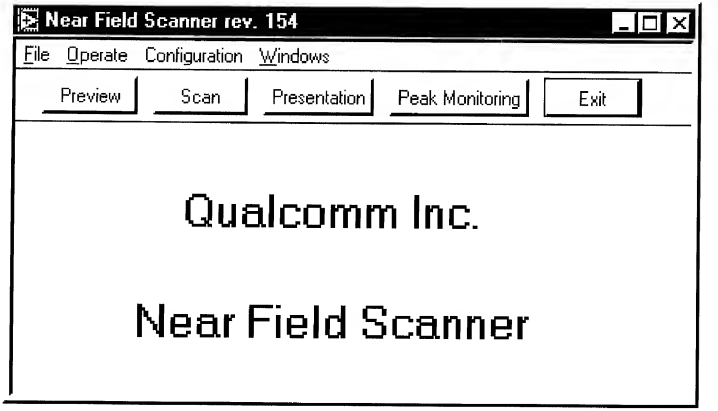

Near Field Scanner rev. 154
File Operate Configuration Windows
Preview
Scan
Presentation
Peak Monitoring
Exit
Qualcomm Inc.
Near Field Scanner

FIG. 44

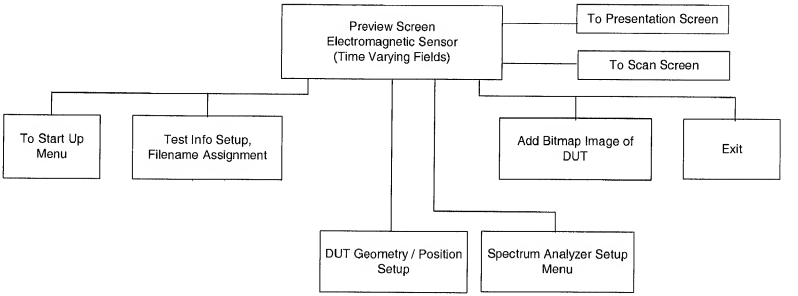
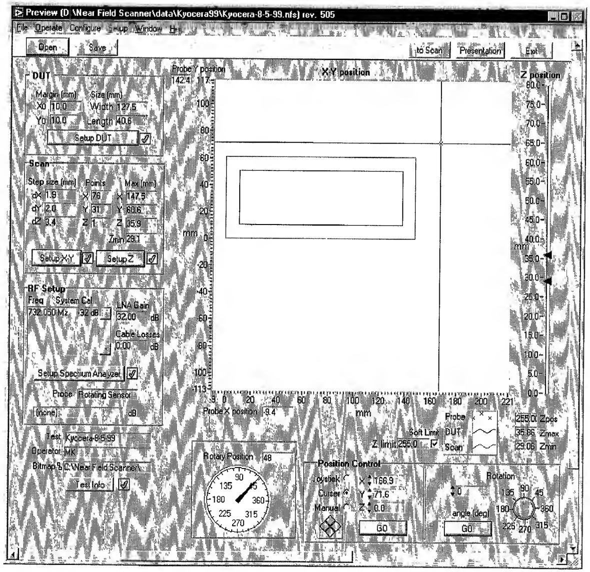


FIG. 45

FIG. 46


Preview (D \Near Field Scanner\data\Kyocera99\Kyocera-8-5-99.nfs) rev. 505
File Operate Configure Setup Window
Open
Save
to Scan
Presentation
Exit
DUT
Margin (mm)
Size (mm)
X0 10.0
Width 127.5
Y0 10.0
Length 40.6
Setup DUT
Scan
Step size (mm)
Points
Max (mm)
dX 1.9
X 76
X 147.5
dY 2.0
Y 31
Y 80.6
dZ 3.4
Z 1
Z 35.9
Zmin 29.1
Setup X-Y
Setup Z
RF Setup
Freq
System Cal
LNA Gain
732.050 Mz
32 dB
32.00
dB
Cable Losses
0.00
dB
Setup Spectrum Analyzer
Probe
Rotating Sensor
(none)
dB
Test Kyocera-8-5-99
Operator MK
Bitmap C:\Near Field Scanner\
Test Info
Probe Y position
142.4
X-Y position
Z position
mm
Probe X position -9.4
Rotary Position 48
Soft Limit
Z limit 255.0
Probe
DUT
Scan
255.0 Zpos
35.86 Zmax
29.06 Zmin
Position Control
Joystick
Cursor
Manual
X 166.9
Y 71.6
Z 0.0
GO
Rotation
0
angle (deg)
GO

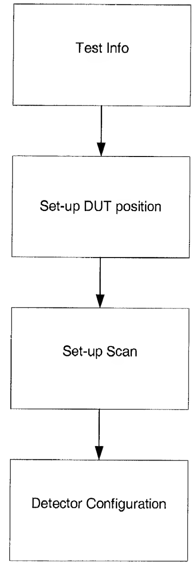

Test Info
Set-up DUT position
Set-up Scan
Detector Configuration

FIG. 47

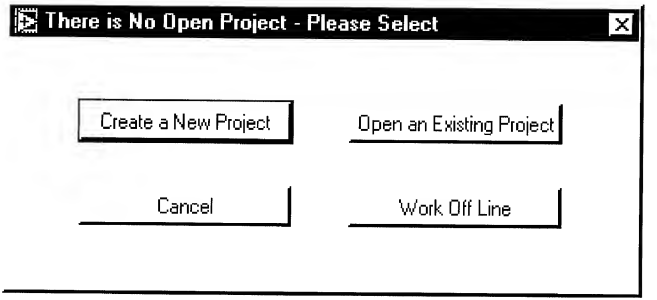

There is No Open Project - Please Select
Create a New Project
Open an Existing Project
Cancel
Work Off Line

FIG. 48

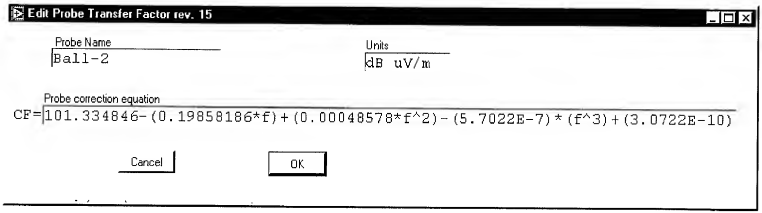

Edit Probe Transfer Factor rev. 15
Probe Name
Ball-2
Units
dB uV/m
Probe correction equation
CF=101.334846-(0.19858186*f)+(0.00048578*f^2)-(5.7022E-7)*(f^3)+(3.0722E-10)
Cancel
OK

FIG. 49

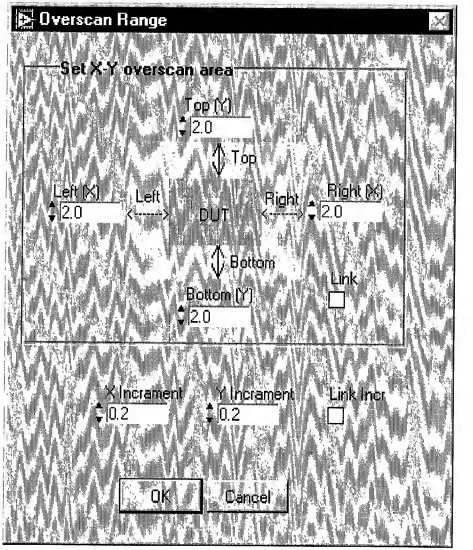


FIG. 50

FIG. 51

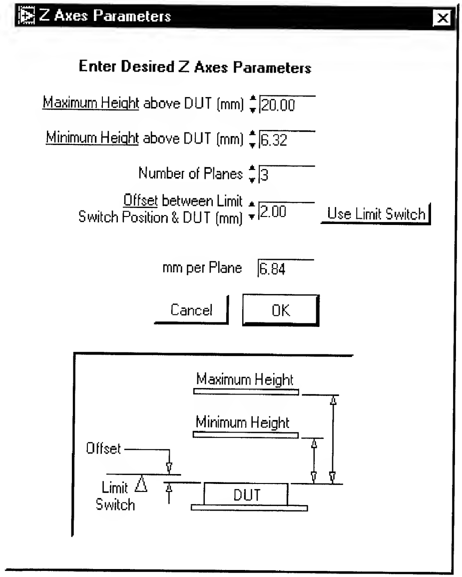
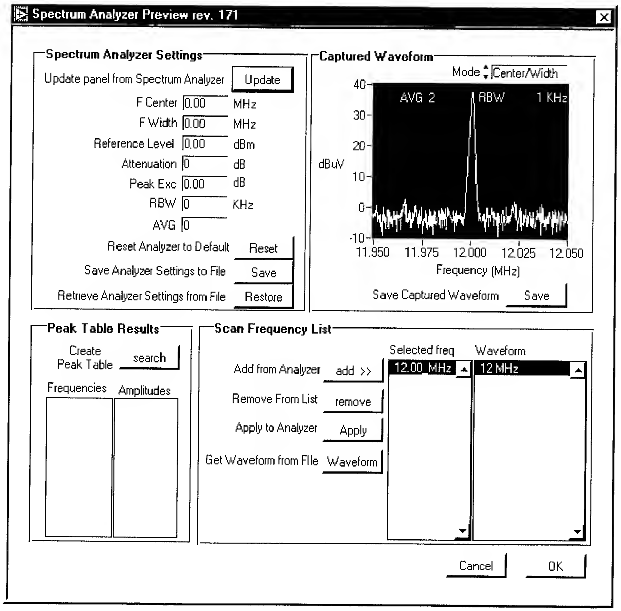
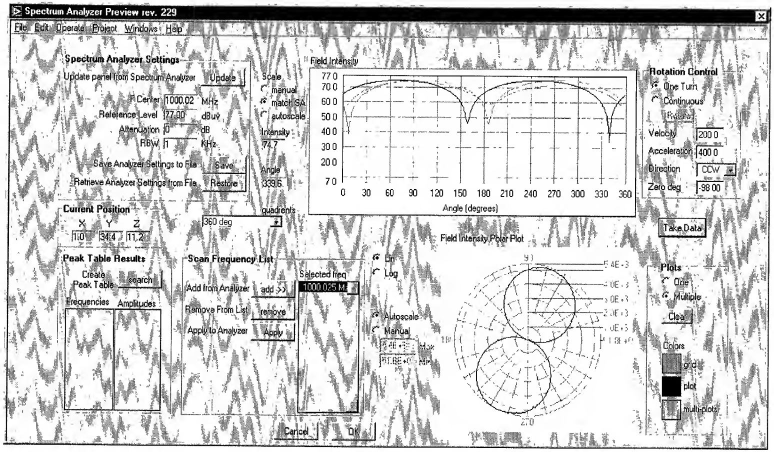

Z Axes Parameters
Enter Desired Z Axes Parameters
Maximum Height above DUT (mm) 20.00
Minimum Height above DUT (mm) 6.32
Number of Planes 3
Offset between Limit Switch Position & DUT (mm) 2.00
Use Limit Switch
mm per Plane 6.84
Cancel
OK
Maximum Height
Minimum Height
Offset
Limit Switch
DUT

FIG. 52


Spectrum Analyzer Preview rev. 171
Spectrum Analyzer Settings
Update panel from Spectrum Analyzer
Update
F Center 0.00 MHz
F Width 0.00 MHz
Reference Level 0.00 dBm
Attenuation 0 dB
Peak Exc 0.00 dB
RBW 0 KHz
AVG 0
Reset Analyzer to Default
Reset
Save Analyzer Settings to File
Save
Retrieve Analyzer Settings from File
Restore
Captured Waveform
Mode
Center/Width
AVG 2
RBW
1 KHz
dBuV
40
30
20
10
0
-10
11.950
11.975
12.000
12.025
12.050
Frequency (MHz)
Save Captured Waveform
Save
Peak Table Results
Create Peak Table
search
Frequencies
Amplitudes
Scan Frequency List
Selected freq
Waveform
Add from Analyzer
add >>
12.00 MHz
12 MHz
Remove From List
remove
Apply to Analyzer
Apply
Get Waveform from File
Waveform
Cancel
OK



Spectrum Analyzer Preview rev. 229
File Edit Operate Project Windows Help
Spectrum Analyzer Settings
Update panel from Spectrum Analyzer
Update
F Center 1000.02 MHz
Reference Level 77.00 dBuv
Attenuation 0 dB
RBW 1 KHz
Save Analyzer Settings to File
Save
Retrieve Analyzer Settings from File
Restore
Scale
manual
match SA
autoscale
Intensity
74.7
Angle
339.6
quadrents
360 deg
Field Intensity
Angle (degrees)
Current Position
X Y Z
1.0 34.4 11.2
Peak Table Results
Create Peak Table
search
Frequencies
Amplitudes
Scan Frequency List
Add from Analyzer
add >>
Remove From List
remove
Apply to Analyzer
Apply
Selected freq
Lin
Log
Autoscale
Manual
Max
Min
Field Intensity Polar Plot
Rotation Control
One Turn
Continuous
Velocity 200.0
Acceleration 400.0
Direction CCW
Zero deg -98.00
Take Data
Plots
One
Multiple
Clear
Colors
grid
plot
multi-plots
Cancel
OK

FIG. 53

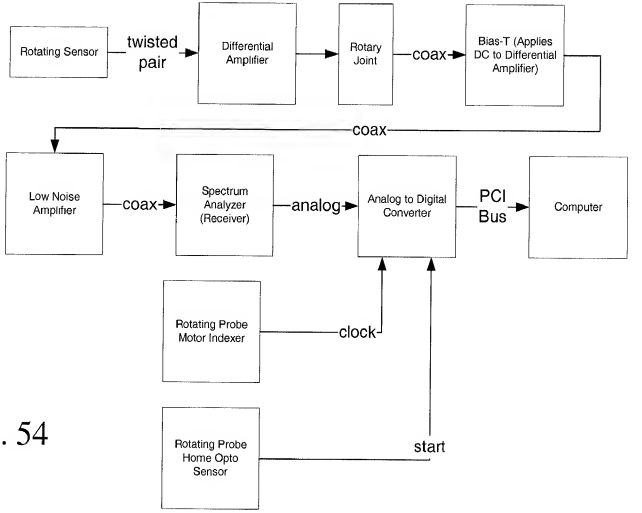


FIG. 54

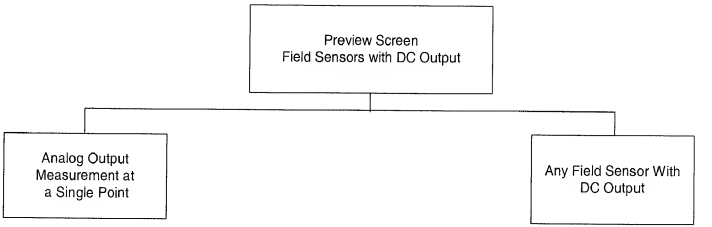

Preview Screen
Field Sensors with DC Output
Analog Output
Measurement at
a Single Point
Any Field Sensor With
DC Output

FIG. 55

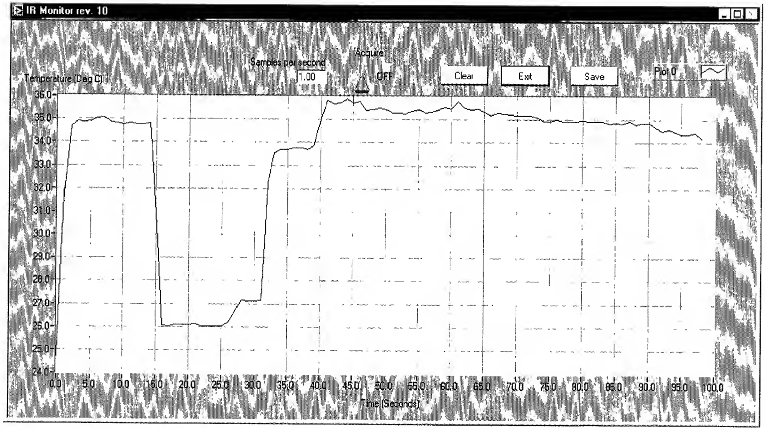

IR Monitor rev. 10
Samples per second
1.00
Acquire
OFF
Clear
Exit
Save
Plot 0
Temperature (Deg C)
36.0
35.0
34.0
33.0
32.0
31.0
30.0
29.0
28.0
27.0
26.0
25.0
24.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
Time (Seconds)

FIG. 56

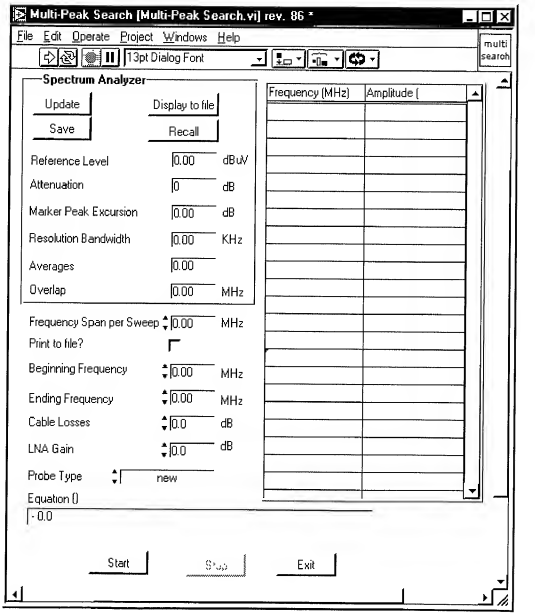

Multi-Peak Search [Multi-Peak Search.vi] rev. 86 *
File Edit Operate Project Windows Help
13pt Dialog Font
multi search
Spectrum Analyzer
Update
Display to file
Save
Recall
Reference Level
0.00
dBuV
Attenuation
0
dB
Marker Peak Excursion
0.00
dB
Resolution Bandwidth
0.00
KHz
Averages
0.00
Overlap
0.00
MHz
Frequency Span per Sweep
0.00
MHz
Print to file?
Beginning Frequency
0.00
MHz
Ending Frequency
0.00
MHz
Cable Losses
0.0
dB
LNA Gain
0.0
dB
Probe Type
new
Equation ()
- 0.0
Frequency (MHz)
Amplitude (
Start
Exit

FIG. 57

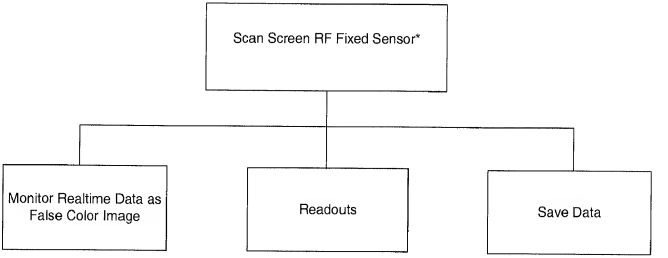


FIG. 58

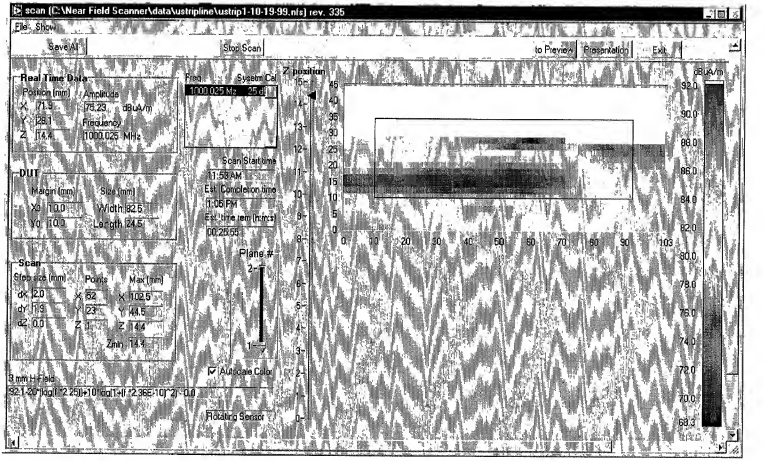
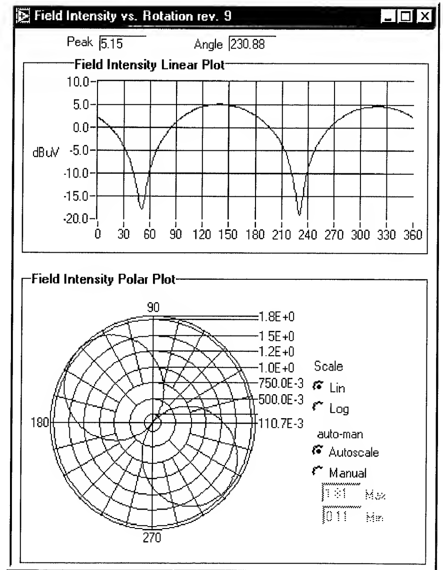

scan (C:\Near Field Scanner\data\ustripline\ustrip1-10-19-99.nfs) rev. 335
File Show
Save All
Stop Scan
to Preview
Presentation
Exit
Real Time Data
Position (mm)
Amplitude
Frequency
1000.025 MHz
DUT
Scan Start time
11:50 AM
Est Completion time
1:06 PM
Est Time rem (h:m:s)
00:25:03
Plane #
Z position
dBuA/m
Auto Scale Color
Floating Sensor

FIG. 59



Field Intensity vs. Rotation rev. 9
Peak 5.15
Angle 230.88
Field Intensity Linear Plot
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
dBuV
0 30 60 90 120 150 180 210 240 270 300 330 360
Field Intensity Polar Plot
90
180
270
1.8E+0
1.5E+0
1.2E+0
1.0E+0
750.0E-3
500.0E-3
110.7E-3
Scale
Lin
Log
auto-man
Autoscale
Manual
Max
Min

FIG. 60

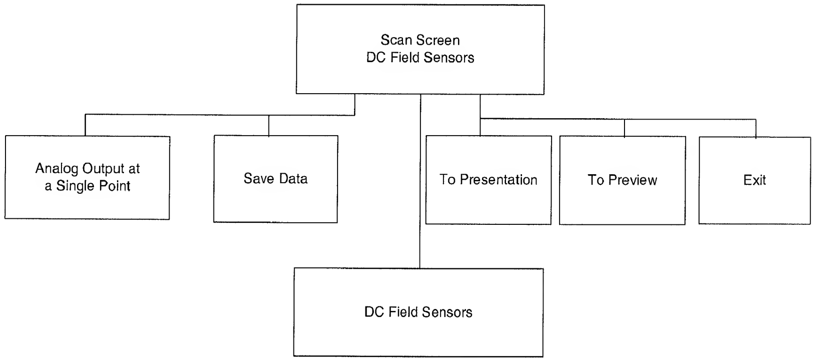

Scan Screen
DC Field Sensors
Analog Output at
a Single Point
Save Data
To Presentation
To Preview
Exit
DC Field Sensors

FIG. 61

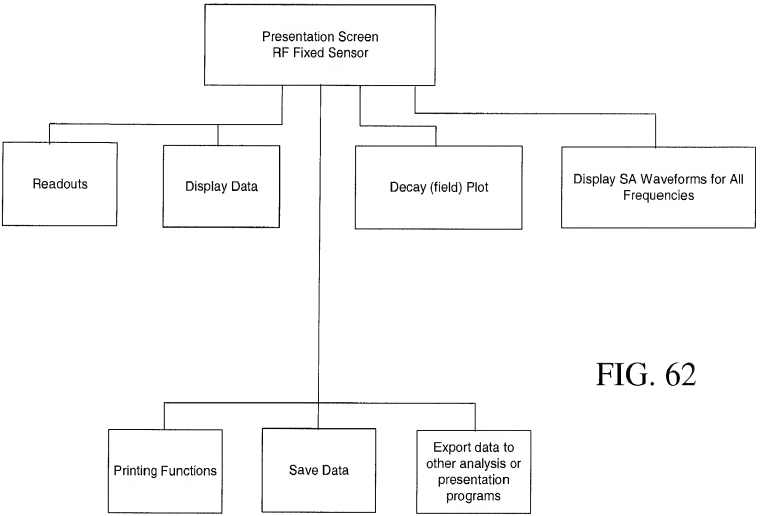
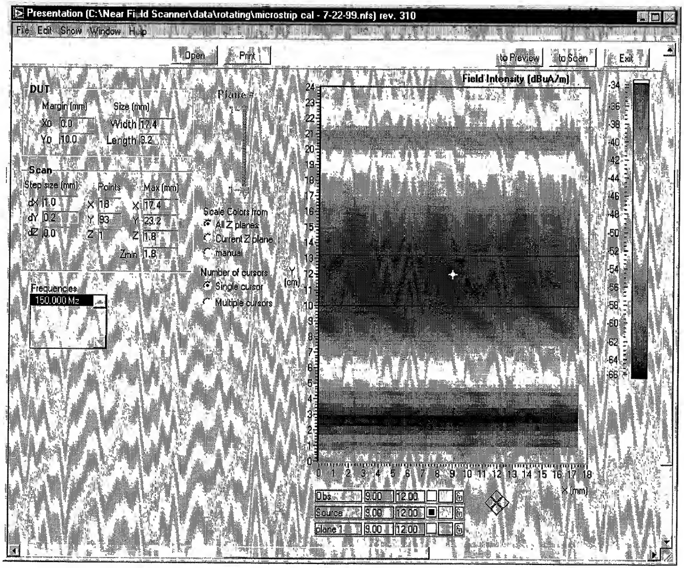

Presentation Screen
RF Fixed Sensor
Readouts
Display Data
Decay (field) Plot
Display SA Waveforms for All Frequencies
Printing Functions
Save Data
Export data to other analysis or presentation programs

FIG. 62



Presentation (C:\Near Fi_ld Scanner\data\rotating\microstrip cal - 7-22-99.nfs) rev. 310
File Edit Show Window Help
Open
Print
to Preview
to Scan
Exit
DUT
Margin (mm)
Size (mm)
X0 0.0
Y0 10.0
Width 17.4
Length 3.2
Scan
Step size (mm)
Points
Max (mm)
dX 1.0
dY 0.2
dZ 0.0
X 18
Y 93
Z 1
X 17.4
Y 23.2
Z 1.8
Zmin 1.8
Frequencies
150.000 Mz
Plane #
Scale Colors from
All Z planes
Current Z plane
manual
Number of cursors
Single cursor
Multiple cursors
Y (cm)
Field Intensity (dBuA/m)
X (mm)
Obs 9.00 12.00
Source 9.00 12.00
plane 1 9.00 12.00

FIG. 63

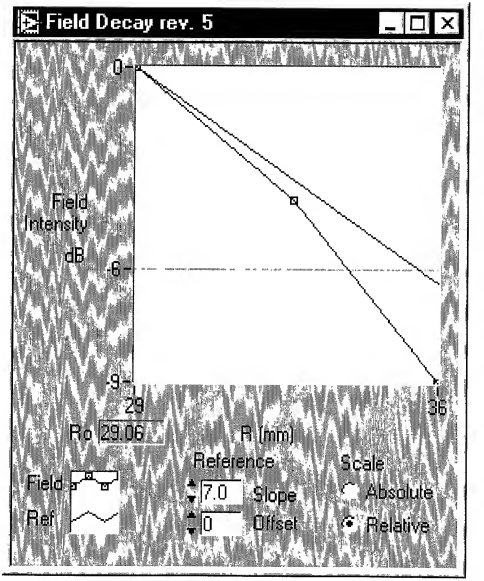


FIG. 64

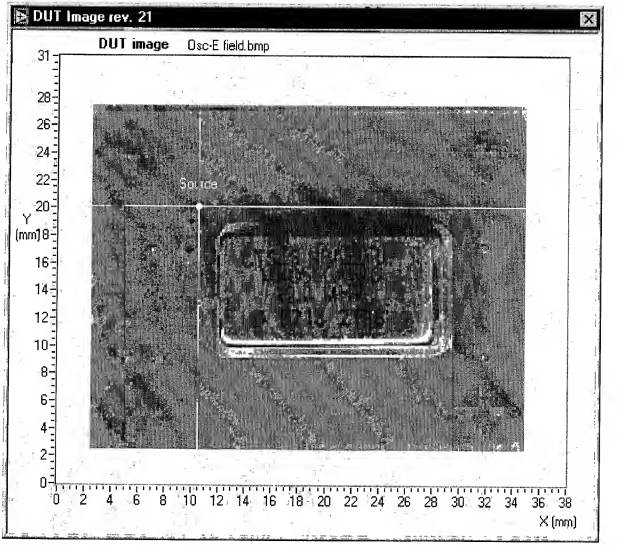
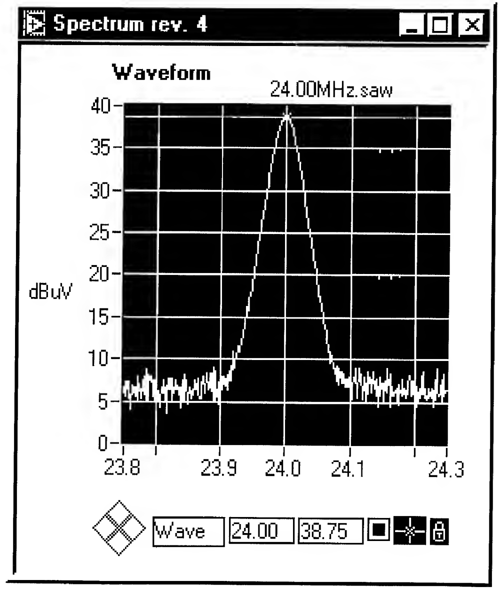

DUT Image rev. 21
DUT image
Osc-E field.bmp
Source
Y (mm)
X (mm)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 31

FIG. 65



Spectrum rev. 4
Waveform
24.00MHz.saw
dBuV
40
35
30
25
20
15
10
5
0
23.8
23.9
24.0
24.1
24.3
Wave
24.00
38.75

FIG. 66

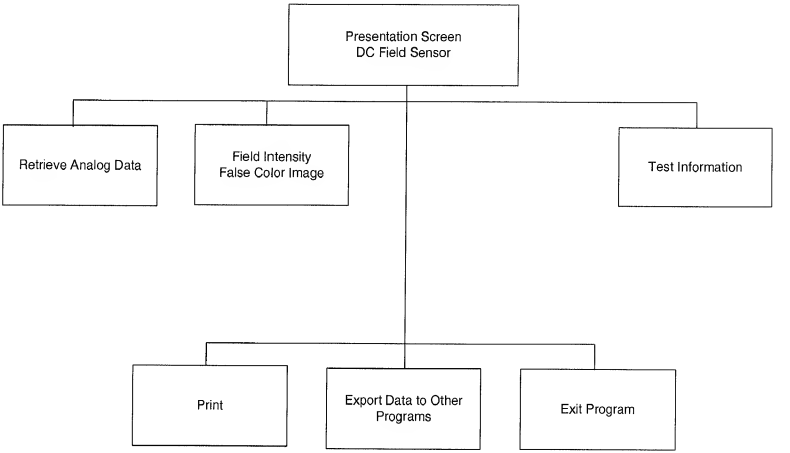


FIG. 67

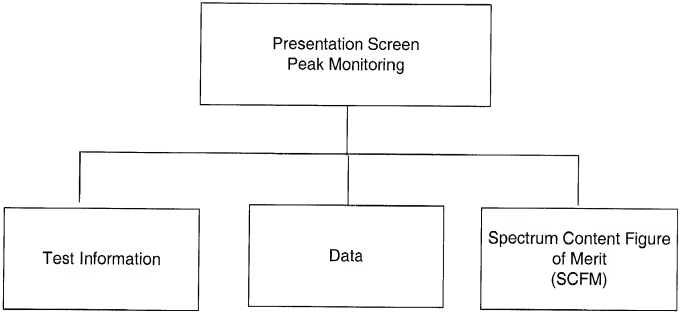

Presentation Screen
Peak Monitoring
Test Information
Data
Spectrum Content Figure of Merit (SCFM)

FIG. 68

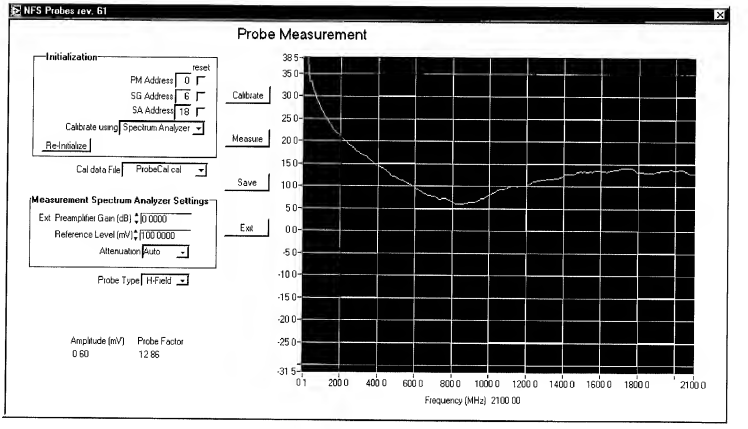

NFS Probes rev. 61
Probe Measurement
Initialization
reset
PM Address 0
SG Address 6
SA Address 18
Calibrate using Spectrum Analyzer
Re-Initialize
Cal data File ProbeCal.cal
Measurement Spectrum Analyzer Settings
Ext. Preamplifier Gain (dB) 0.0000
Reference Level (mV) 100.0000
Attenuation Auto
Probe Type H-Field
Amplitude (mV) Probe Factor
0.60 12.86
Calibrate
Measure
Save
Exit
38.5
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-31.5
0.1
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
1800.0
2100.0
Frequency (MHz) 2100.00

FIG. 69

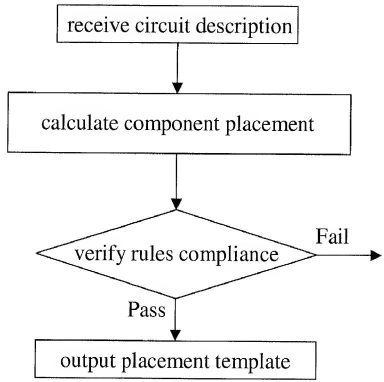


FIG. 70 (RELATED ART)

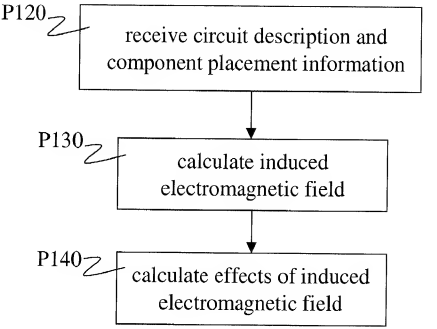


FIG. 71

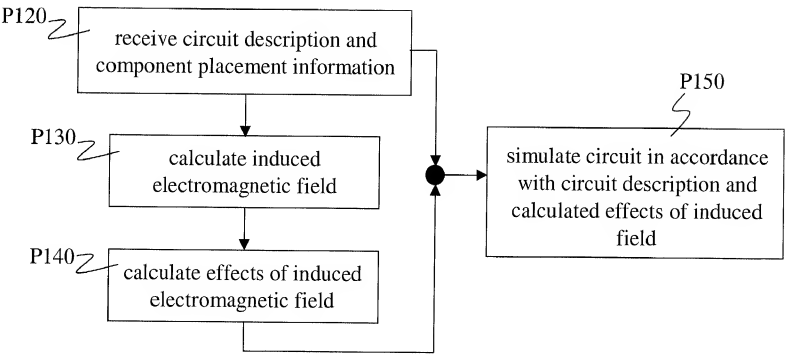


FIG. 72

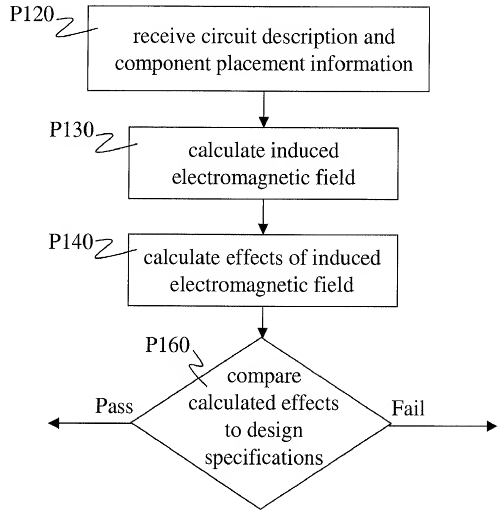

P120
receive circuit description and component placement information
P130
calculate induced electromagnetic field
P140
calculate effects of induced electromagnetic field
P160
compare calculated effects to design specifications
Pass
Fail

FIG. 73

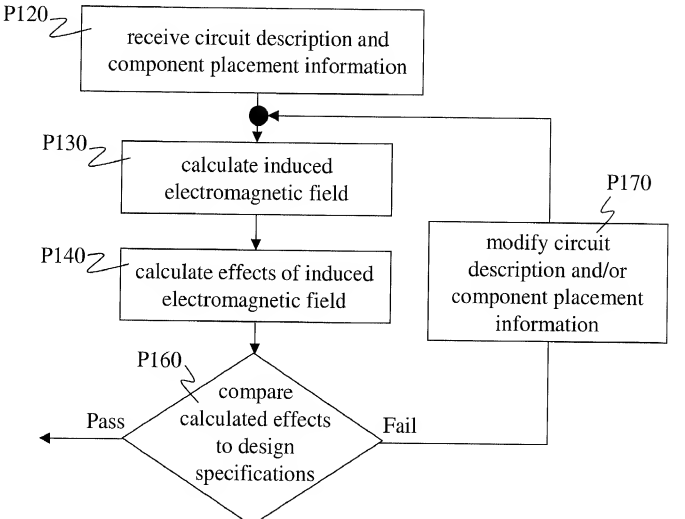


FIG. 74

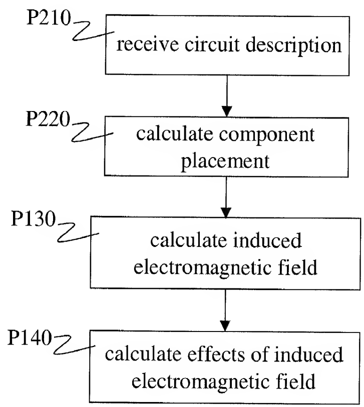

P210
receive circuit description
P220
calculate component placement
P130
calculate induced electromagnetic field
P140
calculate effects of induced electromagnetic field

FIG. 75

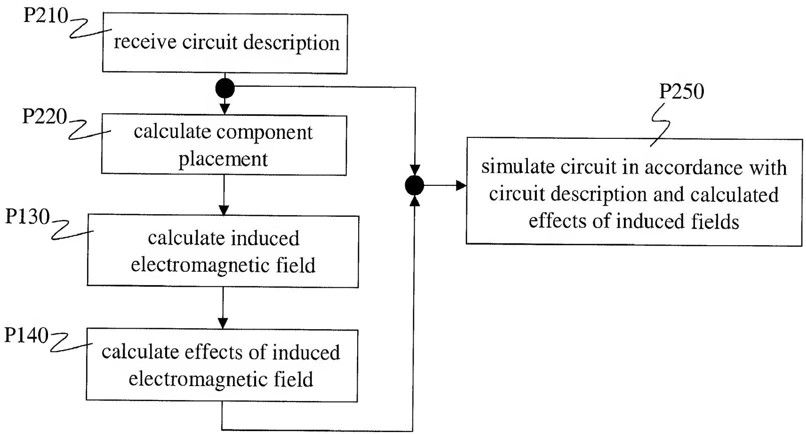

P210
receive circuit description
P220
calculate component placement
P130
calculate induced electromagnetic field
P140
calculate effects of induced electromagnetic field
P250
simulate circuit in accordance with circuit description and calculated effects of induced fields

FIG. 76

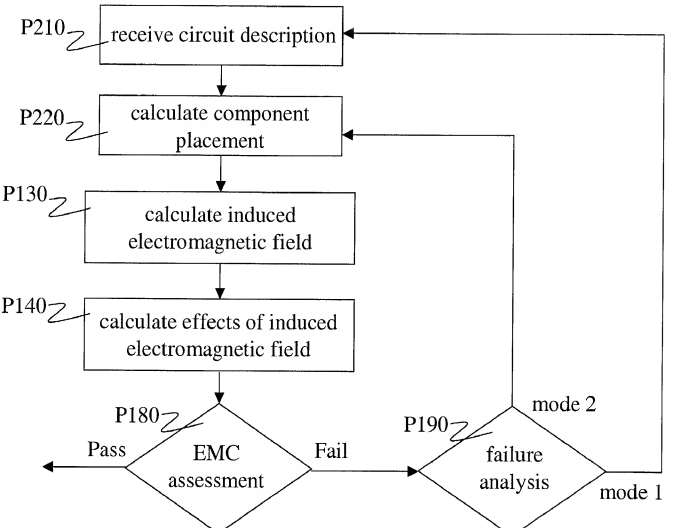

P210
receive circuit description
P220
calculate component placement
P130
calculate induced electromagnetic field
P140
calculate effects of induced electromagnetic field
P180
EMC assessment
Pass
Fail
P190
failure analysis
mode 2
mode 1

FIG. 77

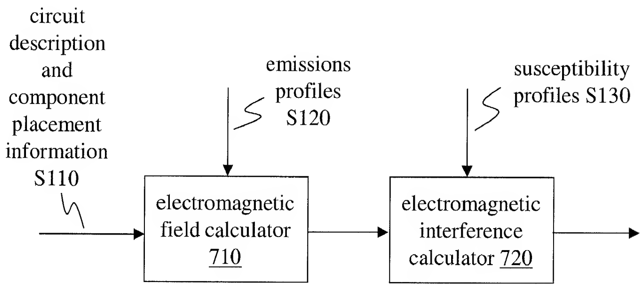

circuit description and component placement information S110
emissions profiles S120
susceptibility profiles S130
electromagnetic field calculator 710
electromagnetic interference calculator 720

FIG. 78

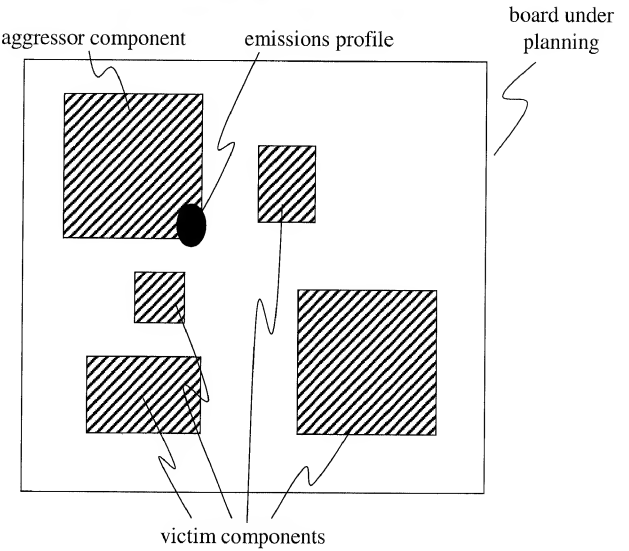


FIG. 79

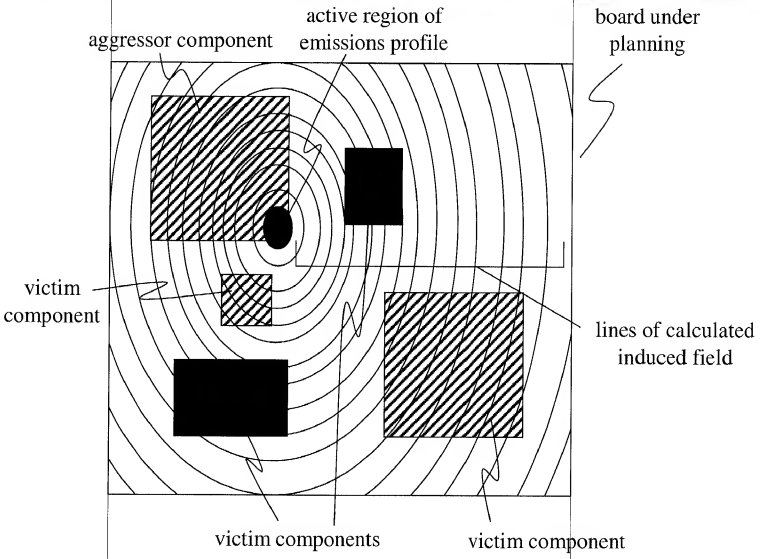

aggressor component
active region of emissions profile
board under planning
victim component
lines of calculated induced field
victim components
victim component

FIG. 80

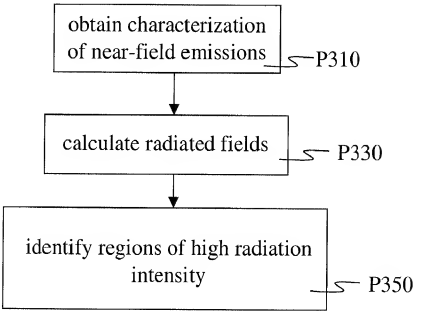


FIG. 81

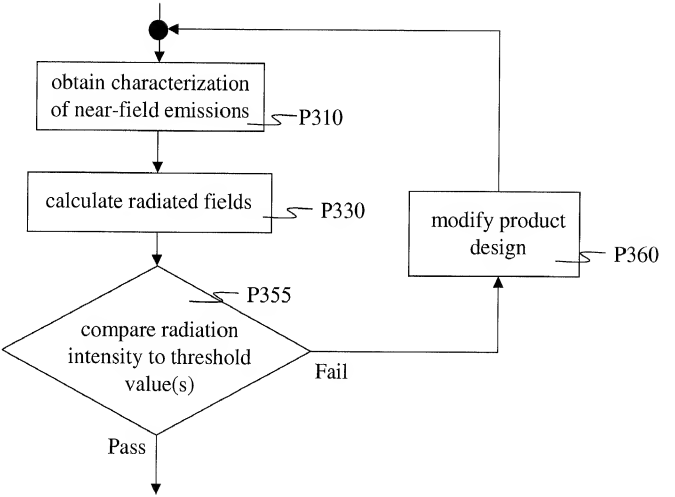


FIG. 82

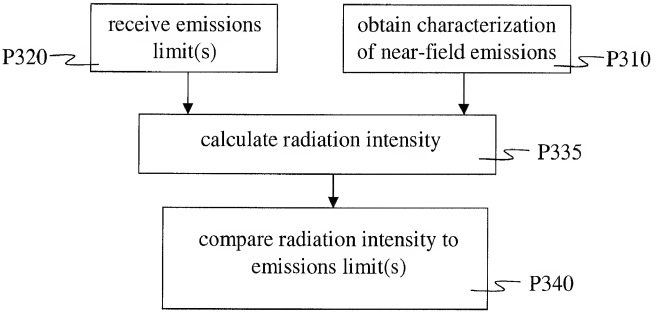


FIG. 83

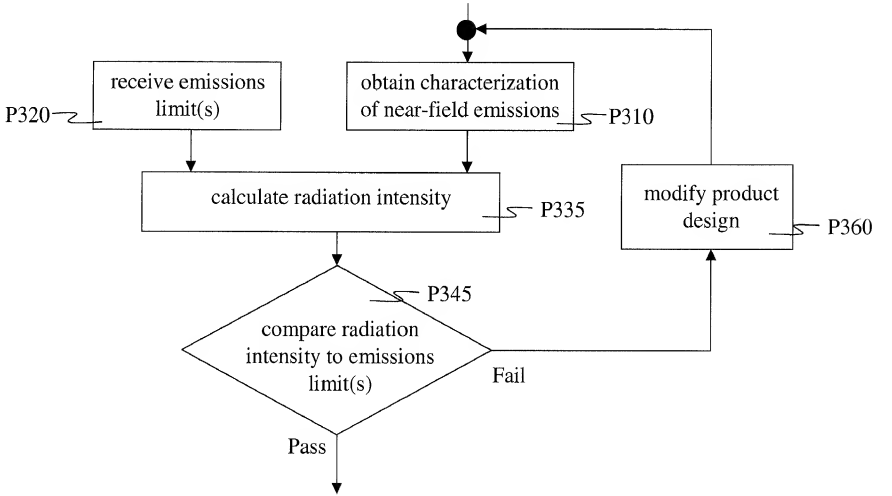


FIG. 84

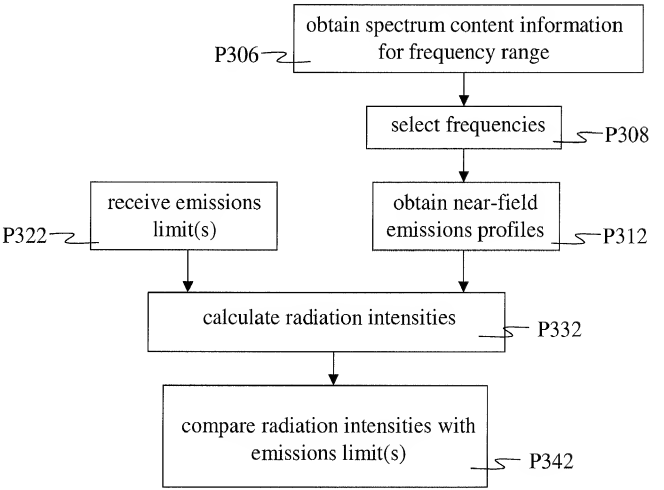
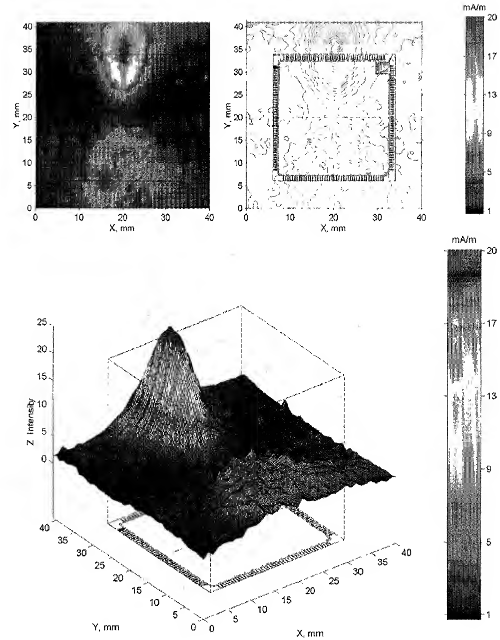

obtain spectrum content information for frequency range
P306
select frequencies
P308
receive emissions limit(s)
P322
obtain near-field emissions profiles
P312
calculate radiation intensities
P332
compare radiation intensities with emissions limit(s)
P342

FIG. 85

FIG. 86



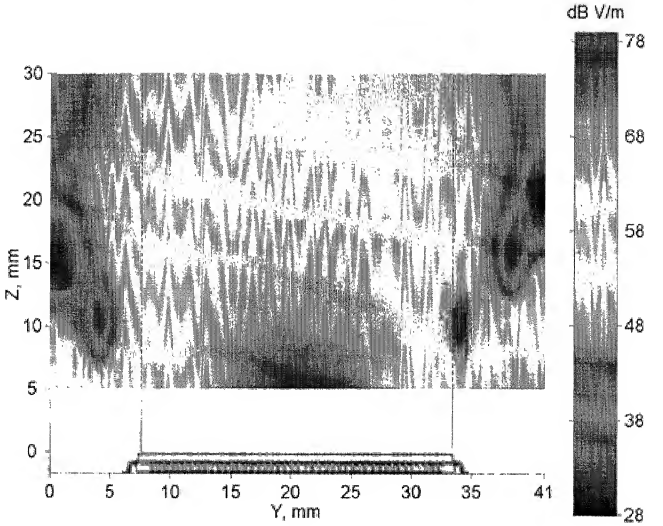
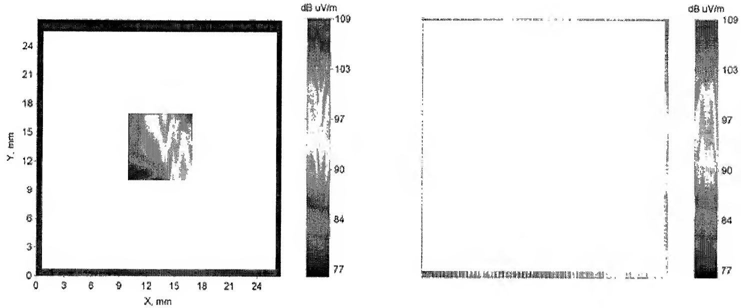


FIG. 87



dB uV/m
109
103
97
90
84
77
Y, mm
24
21
18
15
12
9
6
3
0
X, mm
0
3
6
9
12
15
18
21
24
dB uV/m
109
103
97
90
84
77

FIG. 88

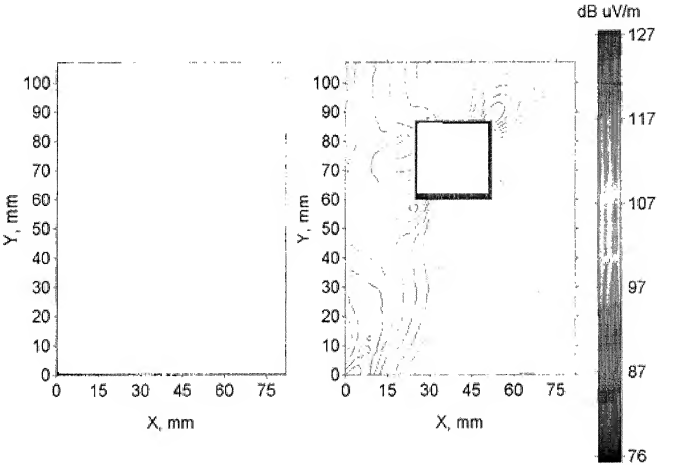

dB uV/m
127
117
107
97
87
76
Y, mm
X, mm
0
10
20
30
40
50
60
70
80
90
100
0
15
30
45
60
75

FIG. 89

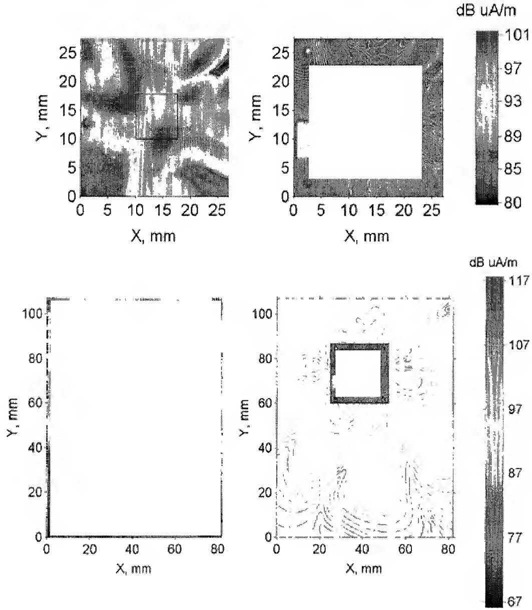


FIG. 90

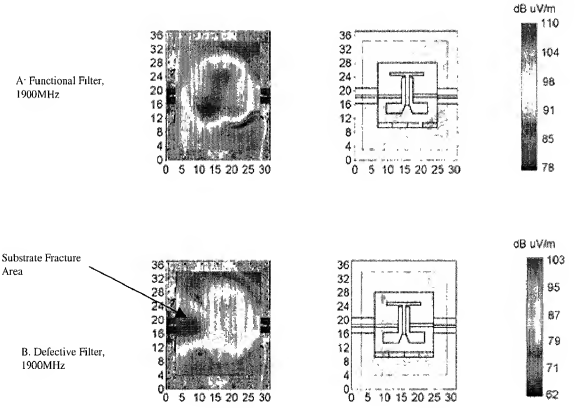

A· Functional Filter, 1900MHz
Substrate Fracture Area
B. Defective Filter, 1900MHz
dB uV/m
110
104
98
91
85
78
dB uV/m
103
95
87
79
71
62
0 5 10 15 20 25 30

FIG. 91

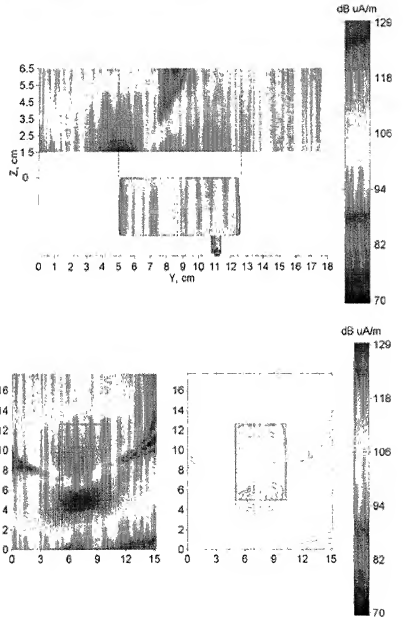

dB uA/m
129
118
106
94
82
70
Z, cm
Y, cm
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
6.5
5.5
4.5
3.5
2.5
1.5
0
0 3 6 9 12 15
16
14
12
10
8
6
4
2
0

FIG. 92

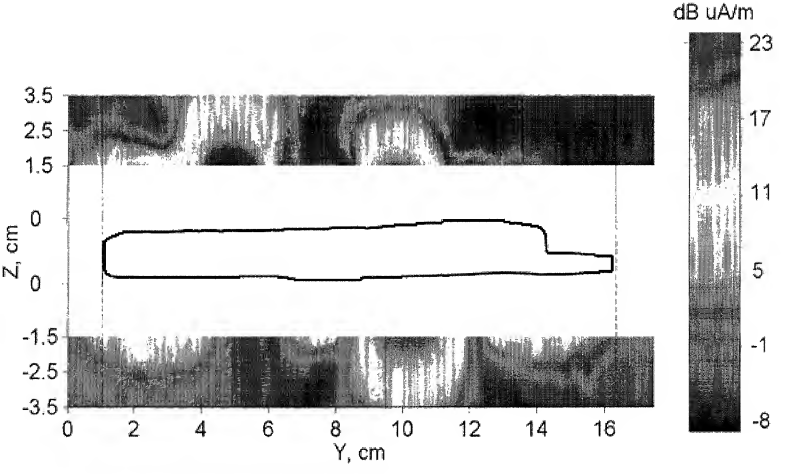
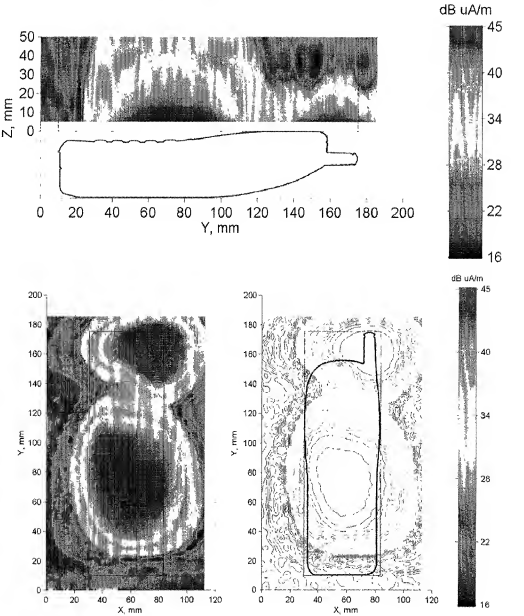


FIG. 93

FIG. 94



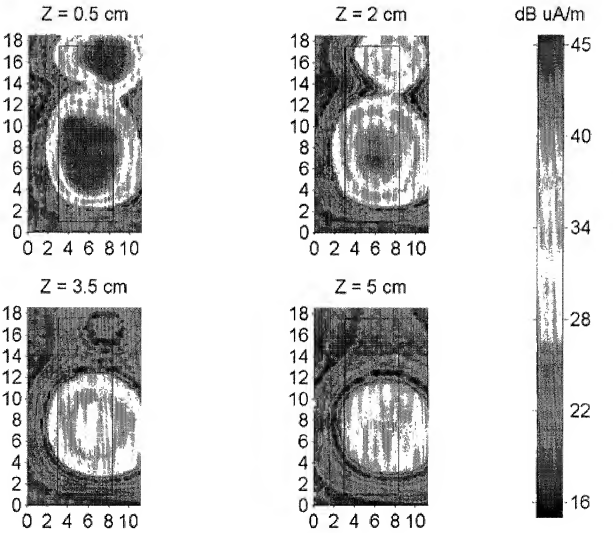


FIG. 95

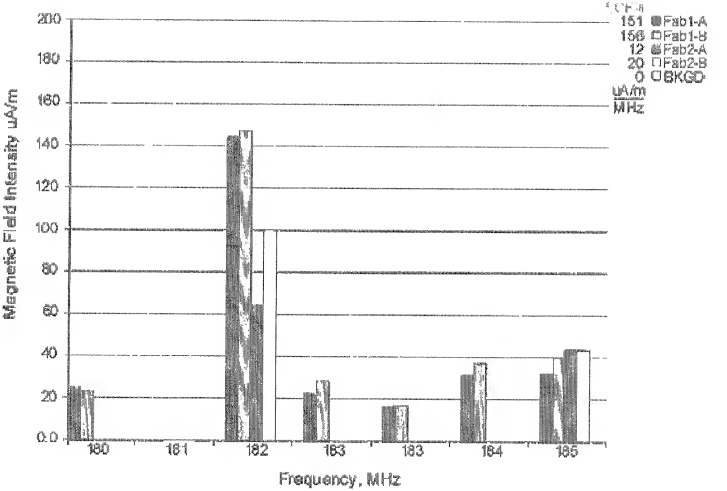

Ch-B
151 Fab1-A
156 Fab1-B
12 Fab2-A
20 Fab2-B
0 BKGD
uA/m
MHz
Magnetic Field Intensity uA/m
200
180
160
140
120
100
80
60
40
20
0.0
180
181
182
183
183
184
185
Frequency, MHz

FIG. 96

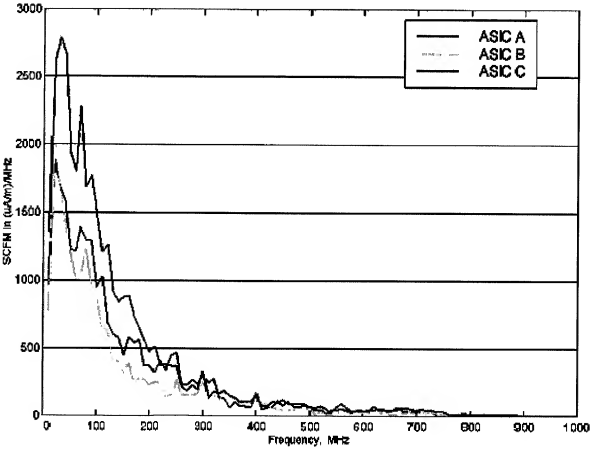


FIG. 97

FIG. 98

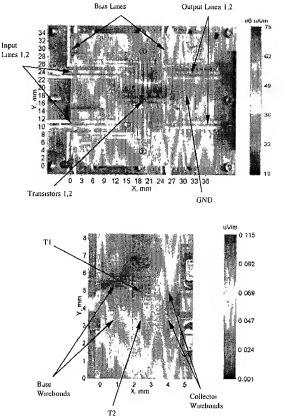
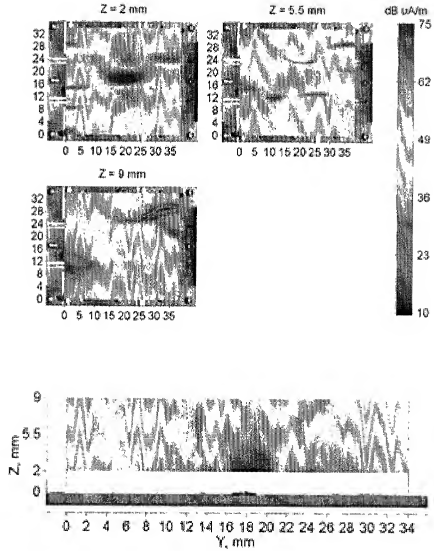


FIG. 99


Z = 2 mm
Z = 5.5 mm
Z = 9 mm
dB uA/m
75
62
49
36
23
10
32
28
24
20
16
12
8
4
0
0 5 10 15 20 25 30 35
Z, mm
9
5.5
2
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34
Y, mm

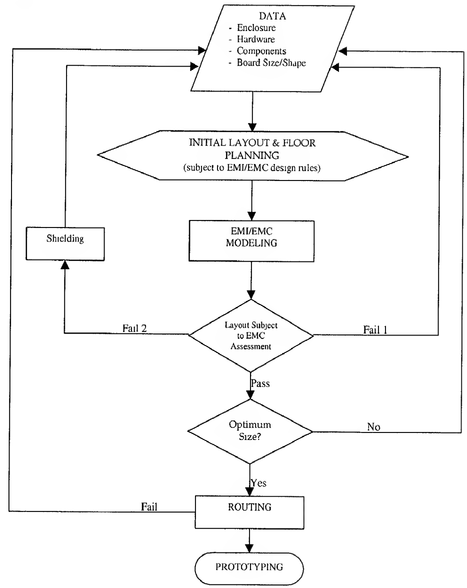

DATA
- Enclosure
- Hardware
- Components
- Board Size/Shape
INITIAL LAYOUT & FLOOR PLANNING
(subject to EMI/EMC design rules)
EMI/EMC MODELING
Layout Subject to EMC Assessment
Fail 1
Fail 2
Shielding
Pass
Optimum Size?
No
Yes
ROUTING
Fail
PROTOTYPING

FIG. 100